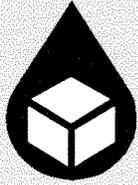
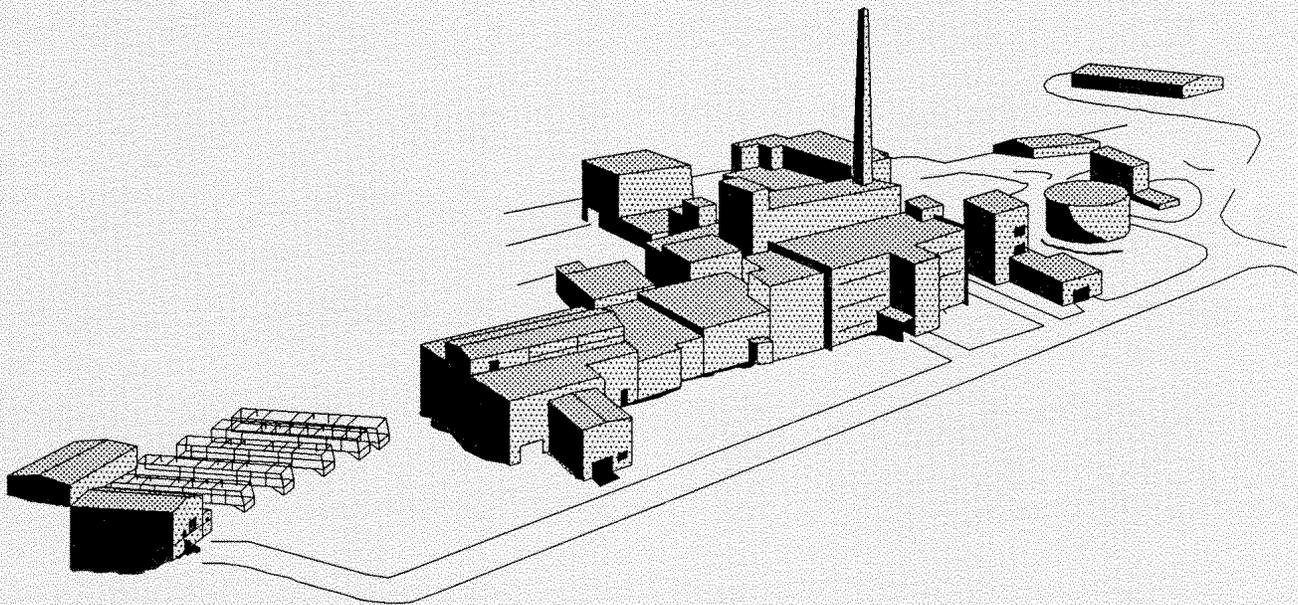

WEST VALLEY DEMONSTRATION PROJECT



SITE ENVIRONMENTAL REPORT

FOR CALENDAR YEAR 1990



May 1991

West Valley Nuclear Services, Inc.

Rock Springs Road

West Valley, New York 14171

PREPARED FOR:
U. S. Department of Energy
Idaho Field Office
West Valley Project Office
Under Contract DE-AC07-81NE44139

West Valley Demonstration Project

Site Environmental Report

for

Calendar Year 1990

Prepared for the Department of Energy

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Preface

Environmental monitoring at the West Valley Demonstration Project (WVDP) is conducted by the West Valley Nuclear Services Company, Inc. (WVNS), under contract to the U.S. Department of Energy. The data collected provide an historical record of radionuclide and radiation levels from natural and manmade sources in the survey area. Data also are collected to monitor the quality of air and water discharged by the Project and the groundwater on and around the site.

This report represents a single, comprehensive source of off-site and on-site environmental monitoring data collected during 1990 by WVNS Environmental Laboratory personnel. Appendix A is a summary of the site environmental monitoring plan. Appendix B lists the environmental permits and regulations pertaining to the West Valley Demonstration Project. Appendices C through E contain summaries of all data obtained during 1990 and are intended for those interested in more detail than is provided in the main body of the report.

Requests for additional copies of the 1990 SITE ENVIRONMENTAL REPORT and questions concerning the report should be referred to the WVDP Community Relations Department, P.O. Box 191, Rock Springs Road, West Valley, New York 14171 (716-942-4610).

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The West Valley Demonstration Project Site

Executive Summary

The West Valley Demonstration Project (WVDP) conducts a comprehensive environmental monitoring program that fulfills regulatory requirements of the United States Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation (NYSDEC). The results of this program show that public health, safety, and the environment are being protected with respect to activities on the site and the waste materials stored there. This annual report, published to meet the requirements of United States Department of Energy (DOE) Orders 5400.1 and 5400.5, summarizes the environmental monitoring data collected during 1990.

On-site and off-site radiological and non-radiological monitoring in 1990 confirm that site activities, with few exceptions, were conducted well within state and federal regulatory limits. The exceptions noted have resulted in no significant impacts upon public health or the environment and are described below.

History of the West Valley Demonstration Project

In the early 1950s interest in promoting peaceful uses of atomic energy led to the passage of an amendment to the Atomic Energy Act under which the Atomic Energy Commission encouraged commercialization of nuclear fuel reprocessing as a way of developing a civilian nuclear industry. The Atomic Energy Commission made its technology available to private industry and invited proposals for the design, construction, and operation of reprocessing plants.

In 1961 the New York Office of Atomic Development acquired 3,345 acres near West Valley, New York and established the Western New York Nuclear Service Center (WNYNSC).

The Davison Chemical Co., co-licensed with the New York State Atomic Research and Development Authority, which later became the New York State Energy Research and Development Authority (NYSERDA), formed Nuclear Fuel Services, Inc. (NFS) to construct and operate a nuclear fuel reprocessing plant. NFS leased the Western New York Nuclear Service Center and began operations in 1966 to recycle fuel from both commercial and federally owned reactors.

In 1972, while the plant was closed for modifications and expansion, more rigorous federal and state safety regulations were imposed. Most of the changes were aimed at the disposal of high-level radioactive liquid waste and at preventing earthquake damage to the facilities. Compliance with the new regulations was deemed not economically feasible and in 1976 NFS notified NYSERDA that it would not continue in the fuel reprocessing business.

Following this decision, the reprocessing plant was shut down. Under the original agreement between NFS and New York State, the state was ultimately responsible for both the radioactive wastes and the facility. Numerous studies followed the closing, leading eventually to the passage of Public Law 96-368, which authorized the Department of Energy to demonstrate a method for solidifying the 2.2 million liters (580,000 gals.) of liquid high-level waste that remained at the West Valley site. The technologies developed at West Valley would be used at other facilities throughout the United States. West Valley Nuclear Services Co. (WVNS), a subsidiary of Westinghouse Electric, was chosen by the Department of Energy (DOE) to be operations contractor for the West Valley Demonstration Project.

The purpose of the West Valley Demonstration Project is to solidify the high-level radioactive waste left at the site from the original nuclear fuel reprocessing activities, develop suitable containers for holding and transporting the solidified waste, arrange transport of the solidified waste to a federal repository, dispose of any Project low-level and transuranic waste resulting from the solidification of high-level waste, and decontaminate and decommission the Project facilities.

Through the mid-1980s West Valley Nuclear Services, as prime contractor to DOE, secured environmental approval and constructed various subsystems that made possible the successful start-up of the integrated radwaste treatment system (IRTS) in May 1988. In the first two years of operation 1,454,000 liters (384,000 gals.) of liquid from the high-level waste tanks were processed through the IRTS. During 1990, 1,030,000 liters (272,000 gals.) of liquid supernatant were processed, solidified in a special cement mixture, and stored on-site in an engineered above-ground vault.

Compliance

The West Valley Demonstration Project operates within the radiological guidelines of Department of Energy Orders for protection of health, safety, and the environment. Limits on radioactivity concentrations and individual doses are specified in the DOE Orders. The Project did not exceed or approach any of the limits on radioactivity or radiation doses in 1990, including the emission standards promulgated by the EPA and incorporated in DOE Orders.

Nonradiological plant effluents are regulated by the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Environmental Protection Agency (EPA). New York State inspects nonradiological air emission points periodically although air effluent monitoring is not currently required because of the very limited discharges. Surface effluent water quality is tested for pH, biochemical oxygen demand and other chemical factors and is regulated by the New York State Department of Environmental Conser-

vation. The State Pollutant Discharge Elimination System (SPDES) permit identifies discharge water quality limits. In 1990 there were nine instances when individual water quality parameters exceeded permitted levels. Six of these deviations resulted from the sewage treatment plant operating beyond its rated capacity. One excursion was attributed to a minor upset that released solids slightly above the permitted limits. Another unrelated excursion of high iron content in the low-level waste treatment system effluent resulted from what is believed to be a natural iron buildup. This condition is being evaluated to determine how the potential for its recurrence can be reduced.

In each case, appropriate actions were taken to stabilize the condition and to notify NYSDEC in accordance with permit requirements. These deviations resulted in no significant effect on the environment. However, the sewage treatment plant operation is being modified to prevent recurrences.

Effects of Project activities upon site groundwaters are regulated by NYSDEC and the EPA. Groundwater sampling and analyses confirm that groundwater quality has been and continues to be affected both radiologically and nonradiologically by past facility operations. Increased well drilling and sampling activities in 1990 intensified the investigation of these effects. Although definite radiological and nonradiological effects upon on-site groundwaters can be seen, these do not affect public health or the off-site environment.

Effluent And Environmental Monitoring

The 1990 environmental monitoring program provided radiological and nonradiological measurements of site effluent discharges and of related on-site and off-site samples. The two major pathways by which radioactive material could migrate off-site were monitored by collecting air and surface water samples. Analysis of animal, soil, and vegetation samples from the facility environs provided data from which the risk of exposure to radioactivity through ingestion pathways could be determined. Control or background samples were taken to compare with on- or

near-site samples. In 1990 the site recorded one instance of radioactivity being transported by a biological vector (flying insects), which was the subject of a special investigation completed in 1990 and is reported in section 2.1.6. A second study, also completed in 1990, evaluated several waste facilities as potential diffuse sources of airborne radioactivity. (See section 2.1.6.)

Airborne particulate radioactivity was sampled continuously at five site perimeter and four remote locations during 1990. Sample filters were collected weekly and analyzed for gross alpha and beta radioactivity. Airborne gross activity around the site boundary was, in all cases, indistinguishable from background concentrations measured at the remote locations and was well below the Department of Energy limits (see Appendix B). Direct monitoring of airborne effluents at the main plant stack and other permitted release points showed all discharges to be well below DOE or EPA effluent limitations. Non-radiological discharges from the site are regulated by NYSDEC; however, no special monitoring and reporting of nonradiological airborne effluents are required.

Six automatic samplers collected surface water at locations along site drainage channels. Samples were analyzed for gross alpha, gross beta and gamma activity, and for tritium and strontium-90. Analyses of carbon-14, iodine-129, and americium-241 were added to the program requirements at several collection points. As a result of past site activities and continuing releases of treated liquids, gross radioactivity concentrations remained higher in Buttermilk Creek below the West Valley Project site than at the upstream background sample point. Yearly average concentrations in water below the Project site in Cattaraugus Creek during 1990 were indistinguishable from background concentrations measured in Buttermilk Creek upstream of the Project facilities. All Cattaraugus Creek concentrations observed are well below regulatory limits. Concentrations of cesium-137, strontium-90, and tritium were below DOE guidelines at all locations, including Frank's Creek at the inner site security fence more than three miles from Cattaraugus Creek.

The low-level liquid waste treatment facility (LLWTF) contributes most of the activity released from the site in liquid discharges. The 1990 annual average liquid effluent concentrations of radionuclides were below DOE release guidelines at the point of discharge.

Radioactivity that could pass through the food chain was measured by sampling milk, beef, hay, corn, apples, beans, fish, and venison. Available results were not very different from 1989 and corroborated the low doses calculated from the measured concentrations in site effluents.

Nonradiological liquid discharges are monitored as a requirement of the State Pollutant Discharge Elimination System (SPDES). Liquid is discharged at permitted outfalls or points of final release to surface waters. Project effluents are monitored for biochemical oxygen demand (BOD), suspended solids, ammonia, iron, pH, oil and grease, and other water quality indicators. Monitoring indicated that non-radiological liquid discharges had no effect on the off-site environment.

Direct environmental radiation was measured continuously during each quarter in 1990, as in previous years, using thermoluminescent dosimeters (TLDs). Monitoring is carried out at forty-one points distributed around the site perimeter and access road, at the waste management units, at the inner facility fence, and at various background locations. No significant differences were noted among exposure rates measured at background stations and the WNYNSC perimeter locations. Some TLD data were also collected within the restricted area boundary to monitor the exposure from nearby radioactive waste handling and storage facilities.

Groundwater Monitoring

The WVDP is underlain directly by layers of glacial sand, clay and rock, and/or by layers of deposited lake and stream materials. The underlying bedrock is primarily Devonian shales and sandstones. As the material deposited across the site is not uniformly distributed, groundwater flow and seepage rates are uneven.

The 1990 groundwater monitoring network included on-site wells for surveillance of solid waste management units and off-site wells for drinking water monitoring. The on-site system of seventeen monitoring points was expanded in 1990 to 106 points. The additional wells installed were sampled on a limited program, but they will be in full use in 1991. These wells provided upgradient and downgradient monitoring of the low-level liquid waste treatment facility (LLWTF) lagoons, the high-level waste tank complex, the NRC-licensed disposal area, and other solid waste management units. Wells comprising the existing on-site groundwater monitoring network were each sampled eight times during 1990. All new wells were developed to produce water suitable for analysis and wells associated with several solid waste management units were sampled for a complete set of parameters. After initial physical measurements at each well, samples were collected and analyzed for a variety of radiological and water quality parameters. The range of analyses performed was determined by regulatory requirements and site-specific concerns or needs. Statistical tests were performed to define real differences between up- and downgradient wells.

Data from groundwater monitoring around the LLWTF lagoons indicate that radionuclides from past plant operations have affected groundwater quality. Compared to background, both tritium and gross beta concentrations are elevated in groundwater surrounding the lagoon system. However, the level of tritium contamination has declined steadily since 1982, as indicated by measurements at the french drain outfall. Levels of gross beta activity appear to be rising slightly in some locations, as measured at the french drain outfall and at wells monitoring groundwater in the vicinity of the LLWTF lagoons (WNW86-03, WNW86-04, and WNW86-05). Other measured parameters such as pH and conductivity have shown significant differences between upgradient and downgradient locations. Most notable are the sodium and chloride concentrations at well WNW86-06, which is upgradient of the lagoons. It is believed that these elevated salt concentrations are due to migration from the sludge ponds which, in turn, are located just upgradient of well WNW86-06.

Data from monitoring wells around the high-level waste tanks do not suggest any effect of the stored high-level radioactive waste on the groundwater. However, significant radiological differences between upgradient and downgradient wells do indicate that previous site activities have affected groundwater in this area. Most notable are elevated levels of gross beta activity and greater-than-detectable concentrations of 1,1-dichloroethane at wells WNW86-09 and WNW86-12.

Groundwater monitoring around the NRC-licensed disposal area (NDA) indicates no discernible effects on the deeper deposits in the area, as indicated primarily by measurements for tritium. However, one shallow well in the vicinity of the NDA (WNW82-4A1) has consistently shown elevated tritium levels. In addition, continued organic solvent migration was detected in other shallow wells within the NDA. Migration of contaminated solvent is currently the focus of a control and remediation effort within the NDA (see section 2.1.6).

The potential effect of Project activities on near-site groundwater is monitored by annual sampling of designated private drinking water wells in addition to the on-site measurements. Monitoring of these wells continues to demonstrate that the site has had no effect on residential drinking water supplies.

Radiological Dose Assessment

Potential radiation doses to the public from airborne and liquid effluent releases of radioactivity from the site during 1990 were estimated via computer models. Potential radiation doses from ingestion of locally produced foods were also calculated and compared to results derived from the computer models.

The EPA-approved computer programs AIRDOS-PC, version 3.0, and CAP-88 were used to calculate hypothetical radiation doses from airborne effluents. The highest effective dose equivalent (EDE) to a nearby resident was estimated to be 0.0007 mrem, which is 0.007% of the EPA limit. The collective dose to all persons within a 50-mile radius was estimated to be 0.008 person-rem EDE.

Computer modeling was also used to estimate a hypothetical maximum radiation dose from liquid effluents. The highest EDE to an individual was estimated to be 0.23 mrem, which is 0.23% of the DOE limit. Overall, the average EDE from air and liquid discharges to individuals within an 80-kilometer (50-mi) radius of the site was calculated to be 2.8×10^{-5} mrem.

Radiation doses estimated from maximum consumption rates of locally produced foods are similar in magnitude to the values reported in previous years.

The above conservatively high, hypothetical calculated doses can be compared to an average dose of 300 mrem per year to a U.S. resident from natural background radiation. The dose assessment described in Chapter 4 predicts an insignificant effect on the public's health as a result of radiological releases from the WVDP.

Quality Assurance

The Quality Assurance (QA) program overseeing environmental monitoring activities includes the evaluation and control of data from both on-site and off-site sources. Commercial contract laboratories and their internal quality assurance programs are routinely reviewed by site personnel. In addition, commercial laboratories must perform blind analyses of standard or duplicate samples submitted by the WVDP Environmental Laboratory.

WVDP monitoring activities are subject to quality control checks from the time of sample collection through sample analysis and data reduction. Each analytical test of the samples analyzed in the on-site environmental laboratory is reviewed in detail. Specific quality checks include external review of sampling procedures, accurate calibrations using primary standard materials, participation in formal laboratory crosscheck programs (for example, with the EPA and DOE), and outside auditing by organizations that include the U.S. Nuclear Regulatory Commission (NRC), the Department of Energy, and Westinghouse Electric Corporation.

Environmental sample sharing and co-location of measurement points with the New York State Department of Health (NYSDOH) and the Nuclear Regulatory Commission continued in 1990, ensuring that selected samples and locations are routinely measured by two or more independent organizations.

Crosscheck program participation coupled with other internal quality control procedures and external laboratory checks verified the overall high quality of data gathered in 1990. General program adequacy and specific issues of quality assurance were audited by the WVNS quality assurance department in 1990. Isolated problems of quality control and/or program design that were identified by the 1989 Tiger Team and the 1990 audit have been or are currently being remedied. Quarterly self-appraisals, conducted by an independent team of environmental monitoring staff, identify areas needing improvement and track the actions taken to achieve the high quality standards that the environmental monitoring program represents. Overall, the program was found to be satisfactory.



Springville Dam on Cattaraugus Creek

Introduction

The West Valley Site

Location

The West Valley Demonstration Project (WVDP) is located in a rural area approximately 50 kilometers (30 mi) south of Buffalo, New York (Fig.1-1), at an average elevation of 400 meters (1,300 ft) on New York State's western plateau. The plant facilities used by the Project occupy approximately 80 hectares (200 acres) of chain-link fenced area within a 1,350-hectare (3,300-acre) reservation that constitutes the Western New York Nuclear Service Center (WNYNSC). The communities of West Valley, Riceville, Ashford Hollow, and the village of Springville are located within 8 kilometers (5 mi) of the plant. Several roads and one railway pass through the Center, but no human habitation, hunting, fishing, or public access are permitted on the WNYNSC.

Economic Activities

The land immediately adjacent to the WNYNSC is used primarily for agriculture and arboriculture. Cattaraugus Creek provides a water recreation area for swimming, canoeing, and fishing. Although limited irrigation water for adjacent golf course greens and tree farms is taken from Cattaraugus Creek, no public water supply is drawn from the creek downstream of the WNYNSC.

Climate

Although there are recorded extremes of 37°C (98.6 °F) and - 42 °C (- 43.6 °F) in the region, the Western New York climate is moderate, with an average annual tempera-

ture of 7.2 °C (45.0 °F). Rainfall is relatively high, averaging about 104 centimeters (41 in.) per year. Precipitation is evenly distributed throughout the year and is markedly influenced by Lake Erie to the west and, to a lesser extent, by Lake Ontario to the north. Regional winds are predominantly from the west and south at about 4 m/sec (9 mph) during most of the year.

Vegetation and Wildlife

The Western New York Nuclear Service Center lies within the northeastern deciduous forest biome, and the diversity of its vegetation is typical of the region. Equally divided between forest and open land, the site provides habitats especially attractive to white-tailed deer and various indigenous birds, reptiles, and small mammals. No endangered species are known to be present on the WNYNSC.

Geology and Groundwater Hydrology

The WVDP site is underlain by a sequence of glacial deposits that occupy an older valley. The valley is cut into the sedimentary rocks that underlie the entire region and are exposed in the upper drainage channels on the hillsides. The soil is mainly silty till consisting of unconsolidated rock fragments, pebbles, sand, and clays. The uppermost till unit is the Lavery, a very dense, compact, gray, silty clay. Below the Lavery till is a more granular zone, the lacustrine unit, which is made up of silts, sands, and, in some places, gravels that overlie a layered clay. The lacustrine unit, in turn, is underlain by an older glacial till, the Kent till, which is quite similar to the Lavery.

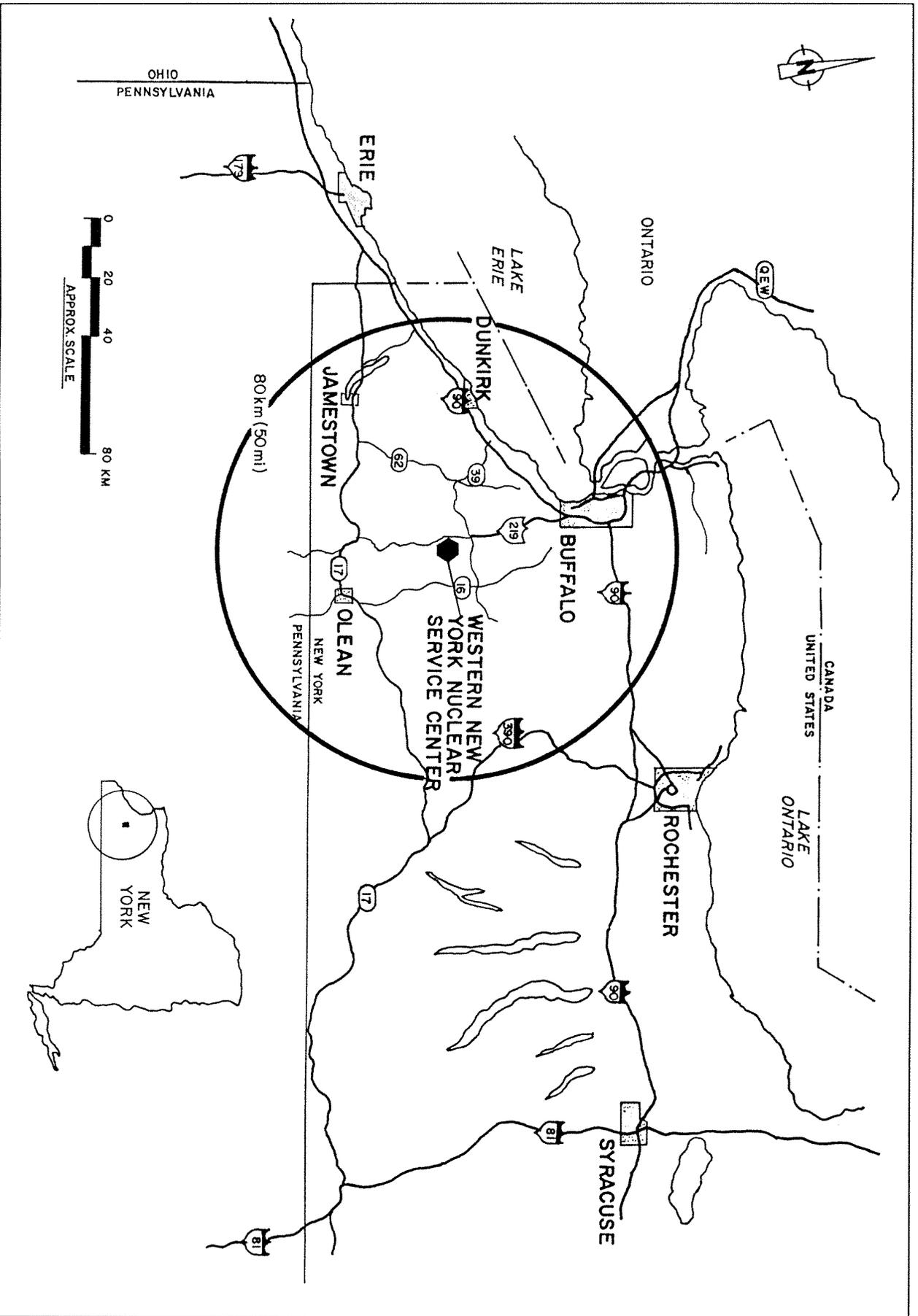


Figure 1-1. Location of the Western New York Nuclear Service Center

There are two aquifers in the site area but neither is considered highly permeable. The upper aquifer is a transient water table aquifer in the upper 6 meters (20 ft) of weathered Lavery till and alluvial gravels concentrated near the western edge of the site. High ground to the west of the WVDP and Buttermilk Creek valley to the east each intersect this aquifer, precluding off-site migration of groundwater. Several shallow, isolated, water-transmitting strata also occur at various other locations within the site boundary but do not appear to be continuous enough to provide avenues for the movement of groundwater from on-site to off-site areas.

The uppermost bedrock is another aquifer consisting of decomposed shale and rubble that ranges in depth from 2 meters (6 ft) underground on the hillsides to 170 meters (560 ft) deep just east of the Project's fenced exclusion area. The groundwater flow patterns are related to the recharge and downgradient movement for the two aquifers. Groundwater in the surficial unit tends to move east or northeast, away from Rock Springs Road. Most of this groundwater empties into Frank's Creek. Groundwater from the lower aquifer tends to move east toward the lowest point of the valley (see Fig. 3-1), about 300-350 meters west of Buttermilk Creek, and may emerge to flow north-northwest as surface water. All surface drainage from the WNYNSC is to Buttermilk Creek, which flows into Cattaraugus Creek and ultimately into Lake Erie.

Environmental Monitoring Program

Monitoring Goals

The environmental monitoring program for the West Valley Demonstration Project began in February 1982. This program has been developed to detect any changes in the environment resulting from Project activities and to assess the effect of any such changes on the human population and the environment surrounding the site. The monitoring network and sample collection schedule have been designed to accommodate specific biological and physical characteristics of the area. Among the several factors considered in

designing the environmental monitoring program were the kinds of wastes and other byproducts produced by the processing of high-level waste; possible routes that radiological and nonradiological contaminants could follow into the environment; geologic, hydrologic, and meteorological site conditions; quality assurance standards for monitoring and sampling procedures and analyses; and the limits and standards set by federal and state governments and agencies. As new processes and systems become part of the program, additional monitoring points are selected for sampling.

General Permit Requirements

Data gathering, analysis, and reporting to meet permit requirements are an integral part of the WVDP monitoring program. Selected media are sampled and analyzed to meet Department of Energy criteria and plant Operational Safety Requirements (OSRs). The West Valley Demonstration Project participates in the State Pollutant Discharge Elimination System (SPDES) as required by the New York State Department of Environmental Conservation (NYSDEC). The site operates under state-issued air discharge permits for nonradiological plant effluents. Radiological air discharges must also comply with the National Emissions Standards for Hazardous Air Pollutants (NESHAP). See the Environmental Compliance Summary, the Environmental Program Information Summary, and Appendix B for more information and a list of permits.

Monitoring and Sampling

The environmental monitoring program is comprised of effluent monitoring, off-site environmental surveillance, and on-site monitoring in which samples are measured for both radiological and nonradiological components. It includes both the continuous recording of data and the collecting of soil, sediment, water, air, and other samples at various times.

On-line air effluent monitoring and sampling of environmental media provide two ways of

assessing the effects of on-site radioactive waste processing. Continuous air effluent monitoring allows rapid evaluation of the environmental effect of site activities. Sampling is slower than monitoring because it must be followed by laboratory analysis of the collected material, but smaller quantities of radioactivity can be detected through the analysis.

Data in Appendices

Appendix A summarizes the 1990 environmental monitoring schedule at both on-site and off-site locations. Samples are designated by a coded abbreviation indicating sample type and location. (A complete listing of the codes is found in the index to Appendix A.) Appendix A lists the kinds of samples taken, the frequency of collection, the parameters analyzed, and the location of the sample points.

Appendix B provides a partial list of the radiation protection standards set by the Department of Energy. It also lists federal and state regulations that affect the WVDP and regulatory permits held by the site.

Appendix C summarizes analytical data from air, water, sediment, and biological samples (meat, milk, food crops, and fish) as well as direct radiation measurements and meteorological monitoring. Both radiological and nonradiological analysis data are provided in tabular format.

Appendix D provides data from the comparison of identically prepared samples (crosscheck analyses) by both the WVDP and independent laboratories. Radiological concentrations in crosscheck samples of air, water, soil, and vegetation are reported here as well as chemical concentrations from water crosscheck samples.

Appendix E summarizes the data collected from groundwater monitoring. Tables and graphs report concentrations at various locations for parameters such as gross alpha and beta, tritium, cesium, dissolved metals, and fluoride.

Exposure Pathways Monitored at the West Valley Demonstration Project

The major pathways for potential movement of radionuclides away from the site are by surface water drainage and airborne transport. For this reason the environmental monitoring program emphasizes the collection of air and surface water samples. Samples are collected on-site at locations from which small amounts of radioactivity are normally released or might possibly be released. Such locations include plant ventilation stacks as well as various water effluent points and surface water drainage locations. Samples of air, water, soils, and biota from the environs of the site indicate any radioactivity that might reach the public from site releases.

Water and Sediment Pathways

Effluent water is collected regularly or, in the case of Lagoon 3, when the lagoon water is released, and is analyzed for various parameters, including gross alpha and gross beta, tritium, and pH. Additional analyses of composite samples determine metals content, biochemical oxygen demand, specific isotopic radioactivity, and specific conductance.

On-site groundwater and surface water samples are collected regularly and analyzed, at a minimum, for gross alpha and beta, tritium, and pH. Selected samples are analyzed for conductivity, chlorides, phenols, heavy metals, volatile organic compounds, and other parameters. Potable water on the site is analyzed monthly for radioactivity and annually for hazardous constituents.

Off-site surface waters, primarily from Cattaraugus Creek and Buttermilk Creek, are sampled both upstream of the Project for background radioactivity and downstream to measure possible Project contributions. Residential drinking water wells located near the site are sampled annually. Sediments deposited downstream of the facility are collected semiannually and analyzed for gross alpha, gross beta, and specific radionuclides. (See Appendix C-1 for data summaries).

Air Pathways

Effluent air emissions on-site are continuously monitored for alpha and beta activity with remote alarms that indicate any unusual rise in radioactivity. Air particulate filters, which are retrieved and analyzed weekly for gross radioactivity, are also composited quarterly and analyzed for strontium-90, isotopic gamma, and specific alpha-emitting nuclides.

Iodine-129 and tritium also are measured in effluent ventilation air. At two locations silica gel-filled columns are used to extract water vapor that is then distilled from the desiccant and analyzed for tritium. Four samplers contain activated charcoal adsorbent that is analyzed for radioiodine. The silica gel columns are analyzed weekly; the charcoal is collected weekly and composited quarterly.

Off-site sampling locations include those considered most representative of background conditions and those most likely to be downwind of airborne releases. Among the criteria used to position off-site air samplers are prevailing wind direction, land usage, and population centers.

Air is continuously sampled at nine locations. Background samplers are located in Great Valley and Dunkirk, New York. Nearby community samplers are in Springville and West Valley, New York. Five samplers are located on the perimeter of the Western New York Nuclear Service Center. These samples are analyzed for parameters similar to the effluent air samples. (See Appendix C-2 for air monitoring data summaries.)

Atmospheric Fallout

An important contributor to environmental radioactivity is atmospheric fallout. Sources of fallout materials include earlier atmospheric testing of atomic explosives and, possibly, residual radioactivity from the Chernobyl nuclear power plant accident. Four site perimeter locations currently are sampled for fallout using pot-type samplers that are collected every month. An on-site fallout pot sampler was added to the program in 1990.

Long-term fallout is determined by analyzing soil collected annually at each of the nine perimeter and off-site air samplers and from an additional site in Little Valley, New York, twenty-six kilometers from the WVDP. (See Appendix C-2 for fallout data summaries and Appendix C-1 for soil data summaries.)

Food Pathways

A potentially significant pathway is the ingestion and assimilation of radionuclides by game animals and fish that include the WVDP in their range. Appropriate animal and fish samples are gathered and analyzed for radionuclide content in order to reveal any long-term trends. Fish are collected at several locations along Cattaraugus Creek and its tributaries at various distances downstream from the WVDP.

Human consumption of domesticated farm animals and produce raised near the WVDP presents another pathway that is monitored. Beef, milk, hay, and produce are collected at nearby farms and at selected locations well away from any possible WVDP influence. (See Appendix C-3 for data summaries.)

Direct Radiation Monitoring

Direct penetrating radiation is continuously monitored using thermoluminescent dosimeters (TLDs) located on- and off-site. Monitoring points within the site are placed at waste management units and the inner facility fence. Other monitoring stations are situated around the site perimeter and access road and at background locations remote from the WVDP. Forty-one monitoring points were used in 1990. The TLDs are retrieved quarterly and analyzed on-site to obtain the integrated gamma exposure. (See Appendix C-4 for data summaries.)

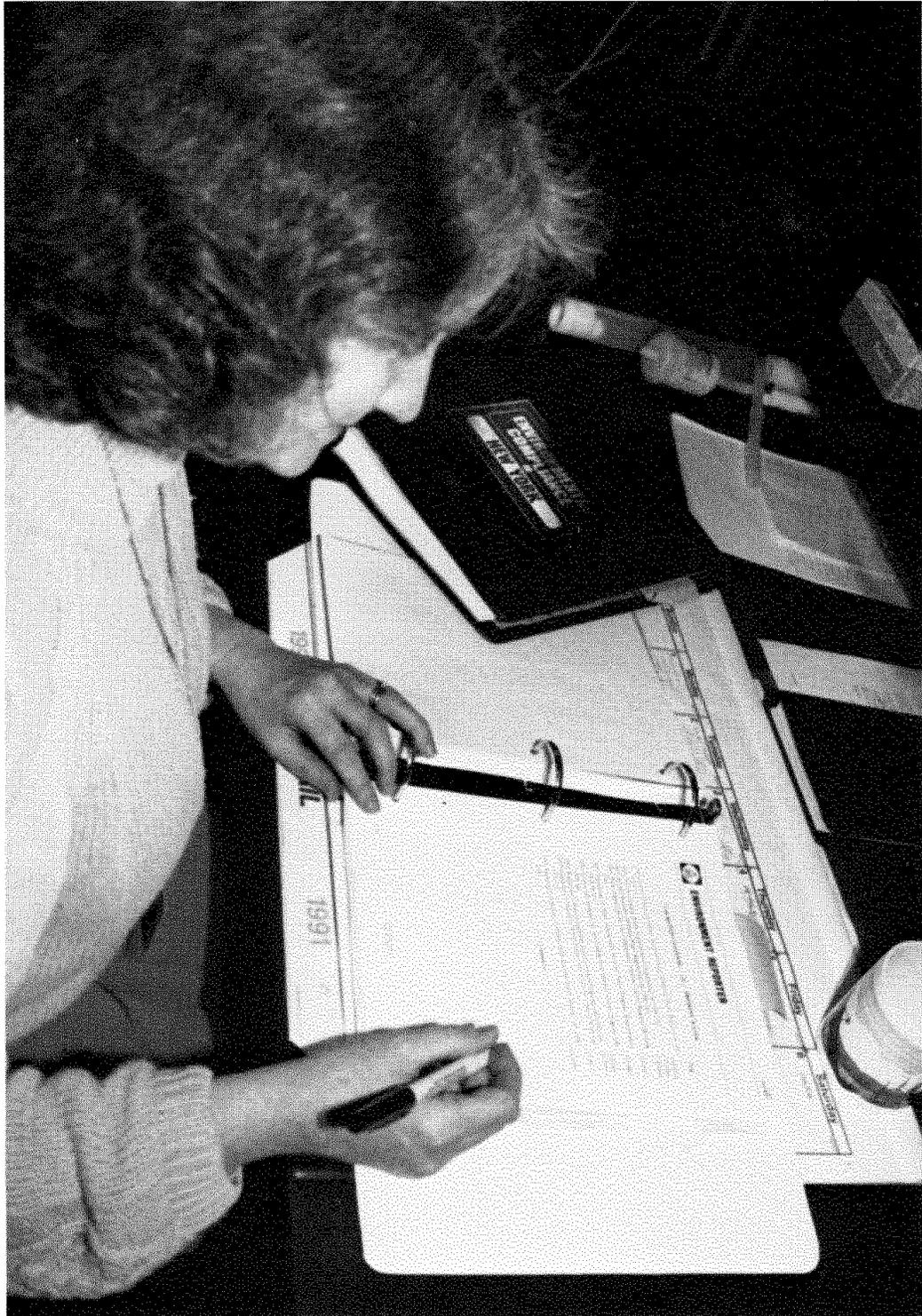
Meteorological Monitoring

Meteorological data are continuously gathered and evaluated on-site. Wind speed and direction, barometric changes, tempera-

ture, and rainfall are all measured. Such data are valuable when evaluating long-term trends and developing dispersion models. In the event of an emergency the data are indispensable for predicting the path and concentration of any materials that become airborne. (See Appendix C-6 for data summaries.)

Quality Assurance and Control

The work performed by and through the on-site environmental laboratory is regularly reviewed by several agencies for accuracy and compliance with applicable regulations. Audits of the laboratory routinely focus on proper record keeping and reporting, timely calibration of equipment, training of personnel, adherence to accepted procedures, and general laboratory safety. Additionally, the Environmental Laboratory participates in several quality assurance crosscheck programs administered by federal or state agencies. Outside laboratories contracted to perform analyses for the WVDP also are regularly subjected to performance audits. (See Appendix D for a summary of crosscheck performance.)



Review of Regulatory Technical Requirements for Recent Changes

Environmental Compliance Summary

Calendar Year 1990

Compliance Status

Environmental compliance activities during 1990 at the West Valley Demonstration Project (WVDP) successfully addressed issues as far reaching as Resource Conservation and Recovery Act (RCRA) applications to radioactive mixed waste (wastes that are both radioactive and hazardous) management and the new Clean Air Act Amendments. Management at the WVDP continues to provide strong support for environmental compliance issues, ensuring that all state and federal statutes and regulations, as well as Department of Energy (DOE) Orders, are integrated into the compliance program at the WVDP.

The following sections provide a review of the compliance activities at the WVDP during 1990.

Clean Air Act (CAA)

The Clean Air Act establishes a comprehensive federal and state framework that regulates air emissions from both stationary and mobile sources. Under the provisions of the CAA any emission sources of a CAA-regulated substance may require a permit or be subject to registration or notification requirements. Emission sources regulated by the CAA may include stacks, ventilators, ventilation ducts, wall fans, open burning, and dust piles. During 1990 the WVDP had sixteen active air permits. (See Table B-3 in Appendix B.)

Nonradiological emissions are regulated by the New York State Department of Environmental Conservation (NYSDEC). The WVDP received approval in 1990 from NYSDEC to modify two boilers and operate four tank

vents. Of the sixteen permits, six are radiological discharges and therefore are regulated under the U. S. Environmental Protection Agency's (EPA) National Emissions Standards for Hazardous Air Pollutants (NESHAP) program.

The annual Environmental Protection Agency's NESHAP inspection in August indicated no noncompliance episodes or notices of violation. Calculations to demonstrate NESHAP compliance showed 1990 doses to be less than .01% of the revised standard of 10 millirem, which became effective in 1990.

The revised standard included a *de minimis* value for which permit applications were not required to be submitted to the EPA. The WVDP performed seven reviews on various radiological release points to determine the need for monitoring and permitting. Two future sources, both related to the vitrification process, will require further review in 1991 for NESHAP permit requirements.

Emergency Preparedness And Community Right-to-Know Act (EPCRA)

The purpose of EPCRA is to encourage and support emergency planning efforts at the state and local levels and to provide local governments and the public with information concerning potential chemical hazards in their communities.

Under EPCRA the West Valley Demonstration Project is required to supply two types of reports to various off-site state and local emergency response organizations. These reports provide information about quantities, locations, and any associated hazards of chemicals used and stored at the site. In addition, the WVDP is required to submit an annual report to the Environmental Protection Agency and

the New York State Department of Environmental Conservation on toxic chemical emissions.

All required reports were submitted to the appropriate organizations by the required deadlines. During the 1990 report period twenty-five chemicals required reporting to state and local emergency response organizations. The 1989 report was submitted as required on July 1, 1990. Annual emissions for three substances — nitric acid, sulfuric acid, and zinc compounds — were reported. The toxic chemical emissions report for 1990 is to be submitted by the July 1, 1991 file date.

Clean Water Act (CWA)

The Clean Water Act is the primary authority for water pollution control programs in the United States. It establishes a National Pollutant Discharge Elimination System (NPDES) for permitting and thus controlling discharges to groundwater and surface water. The Clean Water Act allows authorized states to issue State Pollutant Discharge Elimination System (SPDES) permits. New York State received this authorization and all WVDP point source discharges to surface waters are permitted through the SPDES program.

The WVDP has three permitted outfalls. Outfall 007 discharges the combined effluent from the site's sewage treatment plant and various industrial and potable water treatment systems. Outfall 001 discharges the effluent from the low-level radioactive waste treatment facility (LLWTF). Outfall 008 directs groundwater flow from the northeast side of the site's LLWTF lagoon system through a french drain.

Four batch discharges of treated water from the low-level waste treatment facility, of approximately 2.5 million gallons (9.5 million liters) each, occurred in 1990. The annual average concentration of radioactivity at the point of release was 28% of the DOE derived concentration guides or DCGs (see Glossary). None of the individual releases exceeded the DCGs. (See Table B-1 for a list of the Department of Energy's derived concentration guides.)

Six ammonia measurements and one biochemical oxygen demand measurement in February 1990 outside the permit limits (excursions) at outfall 007 were attributable to the site's sewage treatment plant. Immediate steps were taken to cease all effluent releases from outfall 007 and to determine the cause of the excursions. A technical review of the wastewater treatment system by qualified engineers concluded that the sewage treatment plant was undersized for the population it served. A \$1 million dollar expansion was proposed for the site's sanitary wastewater treatment system and forwarded to NYSDEC for approval, which is expected in 1991. Until the system is approved and constructed, the existing sewage treatment plant has been stabilized by using improved process control techniques.

Two other excursions occurred during the remainder of 1990. One involved a slightly elevated measurement used to determine the amount of solid material (settleable solids) discharged from the site (0.5 mg/L as compared to the permit limit of 0.3 mg/L). This excursion, which occurred at outfall 007, was investigated and concluded to be unrelated to facility operations.

The other excursion occurred at outfall 001 and involved a slightly elevated iron concentration in the effluent (0.87 mg/L as compared to a permit limit of 0.31 mg/L). The level of naturally occurring iron in the raw water used by the Project was determined to be a contributing cause. To address this problem, the WVDP began using a new water treatment chemical after receiving permission from NYSDEC. The chemical (potassium ferrate, a coagulant) has worked very well in reducing the amount of iron in the effluent. A problem with residual iron precipitates in the site's discharge basin remains to be addressed. It is possible that these sediments may become resuspended in the water column during discharge, thus causing an elevated iron value that is not due to the treatment facility's effluent. This issue is currently being investigated for appropriate action.

The New York State Department of Environmental Conservation conducted its annual SPDES inspection on February 27, 1990. Al-

though there were no notices of noncompliance issued, the Project was put on notice that it must resolve the outfall 007 excursion issue or face enforcement action. The actions taken by the Project before, during, and after the inspection were reported as noteworthy during follow-up meetings and precluded the need for enforcement action by NYSDEC.

Safe Drinking Water Act

The WVDP obtains its drinking water from on-site surface water reservoirs. The water is purified by filtration and chlorination before it is distributed to the on-site work force. As an operator of a drinking water supply system, the WVDP has monitoring and reporting requirements. The drinking water program in the State of New York is administered by the New York State Department of Health (NYSDOH) through county health departments. The WVDP is considered a nontransient, noncommunity public water supply.

Monitoring results in 1990 indicated that the Project drinking water met NYSDOH drinking water quality standards. There were no violations or audits of the drinking water program during 1990.

Resource Conservation and Recovery Act (RCRA)

The Resource Conservation and Recovery Act and ensuing amendments were enacted to ensure the environmentally sound management of solid wastes. RCRA programs are implemented by the Environmental Protection Agency unless delegated to individual states. New York has regulatory authority to administer both hazardous waste and radioactive mixed waste. Authority to regulate radioactive mixed wastes was granted to the state by the Environmental Protection Agency in May 1990.

» Radioactive Mixed Waste (RMW) Management Program

Once the EPA granted New York State authorization to regulate radioactive mixed

waste, the WVDP submitted a RCRA Part A Permit Application for on-site treatment and storage of radioactive mixed waste and thus gained RCRA Interim Status. Dual regulation of radioactive mixed waste under both the Atomic Energy Act (AEA) and RCRA occasionally results in conflicting requirements. To resolve these conflicts, the WVDP, like many other federal facilities, began discussions with the New York State Department of Environmental Conservation and the Environmental Protection Agency to negotiate a Federal and State Facilities Compliance Agreement.

Three radioactive mixed waste treatment systems were identified in the Part A permit application.

- The integrated radioactive waste treatment system (IRTS) is used to decontaminate and stabilize high-level radioactive supernatant in cement. The system, which involves treatment by ion exchange and volume reduction prior to solidification, treated 272,000 gallons of supernatant during 1990. Of this, 152,000 gallons were converted to solidified non-hazardous low-level radioactive waste.
- The vitrification system, not yet in operation, will solidify the high-level radioactive waste into glass.
- The third system will be used to treat groundwater captured from the closed Nuclear Regulatory Commission (NRC)-licensed low-level radioactive waste disposal area (NDA).

» Nonradioactive Hazardous Waste

During 1990 the WVDP used off-site, permitted transportation and disposal facilities to dispose of 2.41 tons of nonradioactive hazardous wastes. (Twenty-three tons were transported off-site for disposal in 1989). Sources of these materials ranged from expired laboratory chemicals to maintenance shop wastes. The WVDP also reclaimed, recycled, or rendered nonhazardous by neutralization 8.2 tons of material as part of its waste minimization program.

National Environmental Policy Act (NEPA)

» NEPA Phase I Activities

In February 1990 Secretary of Energy Watkins issued a secretarial directive, SEN-15-90, which modified National Environmental Policy Act compliance procedures at Department of Energy facilities. The directive rescinded NEPA decision-making authority at all Department of Energy project offices and centralized it at DOE headquarters in Washington, D.C. The directive requires "full disclosure and complete assessment" and will result in substantial revision of DOE Order 5440.1, revision and expansion of Department of Energy NEPA procedures, and the elimination of memoranda-to-file. (A memorandum-to-file is a summary of proposed actions that clearly would not have significant environmental effects).

New draft Department of Energy guidelines for complying with the National Environmental Policy Act were developed and published for public review in the Federal Register in November 1990. Comments on the draft, which were received in December 1990, indicated that extensive evaluation was required. Because of delays in review the expected final ruling will be published no sooner than October 31, 1991.

» NEPA Phase II Activities

Phase II site characterization activities in 1990 to support the environmental impact statement (EIS) for closure of the West Valley Demonstration Project were divided into twelve disciplinary areas of investigation: geology, seismology, hydrology, soils characterization, water quality, a radiological survey, a solid waste management unit assessment, air resources, socioeconomics, cultural resources, ecological resources, and pathway assessment.

Initial facility characterization in 1990 consisted of in-depth research into the operational history of the site to gain historical perspective, an overland gamma survey, and surface soil sampling at selected solid waste management units (SWMUs). In addition,

preliminary sediment samples were collected in Lagoons 2 and 3.

Field activities in 1990 included contaminant transport modeling, data collection and analysis of soil temperature and erosion measurements, and the investigation of geochemistry and water quality, groundwater flow, air quality, meteorology, and the distribution of radiological and hazardous contaminants. Demography, land use, and cultural and ecological resources were also studied.

As data was collected and interpreted, public technical information sessions about the progress and initial finds of these site characterization activities were held.

By the end of the year twelve draft environmental information packages (EIPs) had been assembled. These packages, prepared as input for an environmental impact statement contractor, eventually will be published as supporting documentation for the Phase II environmental impact statement.

Medical Waste Tracking

During the latter part of 1989 the state of New York enacted medical waste tracking, transportation, and disposal regulations. The WVDP maintains a medical services facility to provide minor health services for workers. These services include inoculations, first aid treatment, and physical examinations. The WVDP filed notification with NYSDEC that its medical activities would qualify it as a small-quantity medical waste generator (less than fifty pounds per month).

For the 1990 reporting year the WVDP transported two shipments totaling six pounds of regulated medical waste from its on-site medical facility to a licensed disposal facility. The shipments included such items as medical dressings and inoculation needles.

Petroleum Product Spill Reporting

Under an agreed-upon reporting protocol with the New York State Department of En-

vironmental Conservation, the WVDP reports spills of petroleum products that occur on-site in a monthly log, unless the spill comes in contact with environmental media, in which case NYSDEC is immediately notified. During 1990 there were thirty-one minor spills of petroleum products totaling approximately 11 gallons. These spills were typically associated with the heavy industrial equipment currently on-site as a result of increased construction activities.

Of the thirty-one spills only twelve required immediate notification of NYSDEC under the reporting protocol. The remaining nineteen were reported in the monthly log submitted to NYSDEC. All spills were cleaned up in a timely fashion in accordance with the WVDP Spill Prevention, Control and Countermeasures Plan. None of these spills entered drainage or surface waters and none resulted in any adverse environmental impact.

Current Issues and Actions

Resource Conservation and Recovery Act (RCRA)

In the summer of 1989 the U. S. Department of Justice investigated the hazardous waste management program at the WVDP. After a fifteen-month investigation the Department of Justice concluded that no criminal charges were warranted.

The WVDP has been actively engaged in negotiations with the New York State Department of Environmental Conservation and the Environmental Protection Agency to address concerns over the application of NYSDEC hazardous waste regulations to radioactive mixed waste. Eight issues initially identified for NYSDEC and the EPA were targeted for resolution through a Federal and State Facilities Compliance Agreement (FSFCA). Through discussions between technical experts from the WVDP, NYSDEC, and the EPA, tentative resolution of seven of these issues was obtained outside the FSFCA framework through mutually acceptable letters of understanding. Finalization of all agreements is targeted for 1991 and will con-

firm the desire of all parties to see that the WVDP's goal of solidification and stabilization of the high-level radioactive waste continues in an environmentally acceptable fashion.

Concurrent with discussions on the Federal and State Facilities Compliance Agreement, the WVDP has been actively engaged in discussions with NYSDEC and EPA concerning a RCRA 3008(h) Consent Order for potential corrective actions. The Consent Order will confirm the WVDP's intent to fully characterize and ultimately close those facilities associated with the stabilization and solidification of the high-level radioactive waste. Discussions and signing of the Order are targeted for completion in 1991.

Hazardous Materials Transportation

On July 10, 1990 three containers of a non-radioactive, unused, hazardous chemical (zirconyl nitrate) failed enroute while being returned to the manufacturer by the WVDP. The contents of the containers (approximately 165 gallons) leaked from the truck carrying the chemical onto the surface of a roadside highway rest stop.

Initial response by local emergency response organizations quickly neutralized the material, precluding any potential public health or environmental effect. Under the supervision of WVDP personnel the area was cleaned and returned to general access. All cleanup material was properly disposed of as industrial waste through licensed disposers. Subsequent investigations by the WVDP and the U.S. Department of Transportation (DOT) indicated that the container failures were attributable to the use of incompatible containers when the chemical was repackaged for return to the manufacturers.

The Department of Transportation incident review initially concluded that two deviations from DOT regulatory requirements had occurred. After discussions with the WVDP investigation team and consultation with DOT officials in Washington, one of the findings was rescinded. After considering actions taken by WVDP personnel in response to the incident,

the monetary penalty associated with the second finding was reduced from \$10,000 to \$4,000.

Clean Water Act (CWA)

The WVDP undertook two major reviews of its wastewater treatment systems during 1990. Both reviews were designed to address and resolve permit excursions at permitted outfalls 001 and 007. Implementation of the recommendations from these reviews is awaiting NYSDEC review and/or approval.

An engineered interceptor trench and an accompanying liquid pretreatment system downgradient of the NRC-licensed disposal area (NDA) was completed in December 1990. The trench will prevent the migration of potentially contaminated groundwater from the disposal area. This contamination had been detected earlier in groundwater monitoring wells in the NDA. The pre-treated liquids will be further treated in the WVDP low-level waste treatment facility and released via a SPDES-permitted discharge point. As of April 1991 no contaminated groundwater had been detected in the trench system. A modification to the site's SPDES permit to accommodate this waste stream was applied for and approved in 1990.

Tiger Team Assessment

The July 1989 Tiger Team review of the WVDP identified 122 findings/concerns (twelve from the Management Assessment, fifty from the Environmental Assessment, and sixty from the Technical Safety Appraisal) that required 389 specific-action-item responses. As of December 1990 the DOE West Valley Project Office had concurred on closure of 105 of the findings. The Tiger Team Assessment report is available at the WVDP for public review.

Summary of Permits

Environmental permits in effect at the West Valley Demonstration Project during 1990 are listed in Table B-3 of Appendix B. In 1990 the Project received approval to modify its SPDES permit to accommodate wastewaters from the NDA interceptor trench project, submitted an application to renew the SPDES permit (which includes a modification to the site's sewage treatment plant), received a depredation permit to remove barn swallow nests, received approval to modify two air discharge sources, received approval to operate four tank vents, and submitted a RCRA Part A permit application.

Environmental Compliance Summary

First Quarter 1991

Compliance Status

The compliance status of the West Valley Demonstration Project's (WVDP) major environmental programs through the first quarter of 1991 is presented below. The Department of Energy's Idaho Operations Office surveilled the West Valley Demonstration Project's environmental compliance programs and found no environmental, safety, or health deficiencies.

Clean Air Act (CAA)

The New York State Department of Environmental Conservation (NYSDEC) inspected the WVDP's air programs in January 1991 to verify that the permit application for a chemistry laboratory was an accurate representation of the as-built condition. The inspection did not result in any findings and the Certificate to Operate was issued. Certificates to Operate were also received for a paint booth and a source capture welding system.

A package containing information on the vitrification off-gas treatment system was submitted to the U. S. Environmental Protection Agency (EPA) for review. This information will be used to develop a National Emissions Standards for Hazardous Air Pollutants (NESHAP) permit application, to be approved by the EPA, before the system begins to operate.

Emergency Preparedness and Community Right-to-Know Act (EPCRA)

Emergency and Hazardous Chemical Inventory (Tier II) Reports were transmitted to the state and local emergency response organizations by the March 1, 1991 deadline.

A site-wide computer chemical-tracking system that facilitates the reporting process under EPCRA was put into operation.

Clean Water Act (CWA)

The WVDP submitted a proposed sampling and analysis strategy to the New York State Department of Environmental Conservation on March 20, 1991 for gathering data to support the upcoming storm water permit application requirements. Information obtained from NYSDEC and the EPA indicates that agency administration of this program is still uncertain and further guidance may be forthcoming.

Resource Conservation and Recovery Act (RCRA)

The WVDP's hazardous waste and radioactive mixed waste programs were inspected by the New York State Department of Environmental Conservation on March 20 and March 22, 1991. There were no findings or notices of noncompliance. In addition, the outstanding items from a 1989 inspection were closed.

The Annual Hazardous Waste Generator/Waste Minimization Report was submitted to the New York State Department of Environmental Conservation by the March 1, 1991 deadline.

Medical Waste Tracking

A medical waste disposal agreement was signed by the WVDP and a local licensed medical facility on February 12, 1991. The agreement provides for the proper packaging and transport of WVDP medical waste to the medical facility and its subsequent disposal by that facility.

Petroleum Product Spill Reporting

A revised Petroleum Product Spill Reporting Protocol was agreed to by the West Valley Demonstration Project and the New York State Department of Environmental Conservation. The revised protocol expanded the category of nonenvironmental-impact spills that could be recorded in the monthly spill log.

Safe Drinking Water Act

Under new Environmental Protection Agency primary drinking water standards the WVDP will be reviewing the effectiveness of its drinking water treatment system. New performance standards for the removal of certain microorganisms have been issued that require verification that the standards can be met before they become effective.

National Environmental Policy Act (NEPA)

A categorical exclusion is a category of action that normally does not individually or cumulatively have a significant effect on the quality of the human environment and that requires neither an environmental impact statement nor an environmental assessment. Eleven categorical exclusion determinations and one environmental assessment (EA) were prepared and submitted for Department of Energy approval in the first quarter of 1991.

Current Issues and Actions

Resource Conservation and Recovery Act (RCRA)

Based on the conclusion of the U. S. Department of Justice investigation of the West Valley Demonstration Project, which ended in September of 1990 and resulted in no criminal charges, and on discussions with WVDP technical personnel, the New York State Department of Environmental Conservation did not feel any further action was necessary relating to the 1989 hazardous waste program investigation. A March 1991 NYSDEC inspection of the WVDP's hazardous and radioactive

mixed waste management programs resulted in no findings and effectively closed all outstanding issues of NYSDEC's 1989 audit.

Tiger Team Assessment

The 1989 Tiger Team Action Plan response for the WVDP was fully completed, including Project Office concurrence, as of mid-February 1991. The Tiger Team Assessment report is available at the WVDP for public review.

Summary of Permits

Since January 1991 air permit applications for a source capture welding system, a paint booth, and Analytical and Process Chemistry Laboratory equipment were approved by the New York State Department of Environmental Conservation.

In March 1990 a restricted burning permit application required to conduct fire brigade training was submitted to NYSDEC.

A depredation permit for the removal of abandoned barn swallow nests was renewed by the U.S. Fish and Wildlife Service and NYSDEC.

As suggested by NYSDEC, the WVDP prepared an amendment to its RCRA Part A permit application. The amendment expands storage capacity to accommodate an additional facility for the storage of nonradioactive, hazardous wastes.



**Electroshock Fishing for Background Samples
with the New York State Department of Environmental Conservation**

1.0 Environmental Program Information Summary

Radiation and Radioactivity

As the Western New York Nuclear Service Center is no longer an active nuclear fuel reprocessing facility, the major interest of the environmental monitoring program is in the radiation and radioactivity levels associated with the cleanup activities. The following information about radiation and radioactivity may be useful in understanding the activities of the Project and the terms used in reporting the results of environmental testing measurements.

Radioactivity is a property of unstable atomic nuclei that spontaneously disintegrate or change into atomic nuclei of another isotope or element (see Glossary). As the nuclei decay, total radioactivity is reduced until only a stable nonradioactive isotope remains. Depending on the isotope, this process can take anywhere from less than a second to hundreds of thousands of years.

Radiation is a general term used to describe several forms of energy, including the energy that accompanies decay of atomic nuclei. Radiation from radioactive materials that are of primary interest take three forms: alpha or beta particles, and gamma rays.

- Alpha Particles

An alpha particle may be emitted as a fragment from a much larger nucleus. It consists of two protons and two neutrons, just like a helium nucleus, and is positively charged. Alpha particles are relatively large and heavy and do not travel very far when ejected by a decaying nucleus. Alpha radiation thus is easily stopped by a thin layer of material such as paper or skin. However, if radioactive material

is ingested or inhaled, the alpha particles released inside the body can damage soft internal tissues.

- Beta Particles

A beta particle is an electron that results from the breakdown of a neutron in a radioactive nucleus. Beta particles are small compared to alpha particles, travel at a higher speed (close to the speed of light), and can be stopped by a material such as wood or aluminum an inch or so thick. If beta particles are released inside the body they do much less damage than alpha particles, assuming that equal amounts of energy are absorbed by the tissue.

- Gamma Rays

Gamma rays are high-energy “packets” of electromagnetic radiation called photons. They are similar to x-rays but generally have a shorter wavelength and therefore are more energetic than x-rays. If the alpha or beta particle released by the decaying nucleus does not carry off all the energy available, the nucleus rids itself of the excess energy by emitting gamma rays. If the released energy is high a very penetrating gamma ray is produced that can only be effectively reduced by several inches of a heavy element such as lead. Although large amounts of gamma radiation are dangerous, gamma rays are also used in many lifesaving medical procedures.

Ionizing Radiation

Radiation can be damaging if, in colliding with other matter, the alpha or beta particles or gamma rays knock loose electrons from the absorber atoms. This process is called ionization, and the radiation that produces it is

referred to as ionizing radiation because it changes a previously neutral atom into a charged atom called an ion (see Glossary).

Various kinds of ionizing radiation produce different degrees of damage. The **relative biological effectiveness (RBE)** or **quality factor (QF)** of a particular kind of radiation indicates the extent of cell damage it can cause compared with equal amounts of other ionizing radiations. Alpha particles cause twenty times as much damage to internal tissues as x-rays, and so alpha radiation has a quality factor of 20 compared to gamma rays, x-rays, or beta particles.

Background Radiation

Background radiation is always present and everyone is constantly exposed to low levels of such radiation from both naturally occurring and manmade sources. In the United States the average total annual exposure to this low-level background radiation is estimated to be about 360 millirem (mrem) or 3.6 millisieverts (mSv). Most of this radiation, approximately 300 mrem (3 mSv), comes from natural sources. The rest comes from medical procedures and from consumer products.

Background radiation includes cosmic rays, the decay of natural elements such as potassium, uranium, thorium, and radon, and radiation from sources such as chemical fertilizers, smoke detectors, and televisions. Actual doses vary depending on such factors as geographic location, building ventilation, and personal health and habits.

Units of Measurement

Radiation is described in three ways: The rate of emission, the amount of energy absorbed, or the biological effect.

Nuclear disintegrations:

The rate at which radiation is emitted can be described by the number of nuclear transformations that occur in a radioactive material over a fixed period of time. This process, or radioactivity, is measured in curies (Ci) or becquerels (Bq). One becquerel equals one decay

per second. One curie equals 37 billion nuclear disintegrations per second (3.7×10^{10} d/s). Very small amounts of radioactivity are sometimes measured in picocuries. A picocurie is one-trillionth (10^{-12}) of a curie.

Energy absorbed:

Radiation effects can be predicted based on the amount of energy absorbed by the receiving material, measured in rads (radiation absorbed dose) or grays. A rad is defined as a dose of 100 ergs of radiation energy absorbed per gram of material while a gray is one joule of energy absorbed per kilogram of material. Energy can also be expressed in terms of electron volts (eV). However, as an electron volt is such a small amount of energy the preferred unit is a million electron volts (MeV). Thus, a gamma ray photon from barium-137m (from cesium-137) would have an energy of 662,000 eV or 0.662 MeV. (One rad equals 62.4×10^6 MeV of energy per gram of material).

Biological effect:

A third measure of radiation is the rem, the unit of "dose equivalent" that is proportional to the biological damage to tissue produced by different kinds of ionizing radiation. Rems are equal to the number of rads multiplied by a quality factor that is related to the relative biological effectiveness of the radiation involved. Dose equivalents can also be measured in sieverts. One sievert equals 100 rem. (See Chapter 4, "Radiological Dose Assessment," for more information.)

Potential Effects of Radiation

The biological effects of radiation can be either somatic or genetic. *Somatic* effects are restricted to the person exposed to radiation. For example, clouding of the lens of the eye or loss of white blood cells can be caused by sufficiently high exposure to radiation.

Radiation also can cause chromosomes to break or rearrange themselves or to join incorrectly with others. These changes may produce *genetic* effects and may show up in future generations. Radiation-produced genetic

defects and mutations in offspring of an exposed parent, while not positively identified in humans, have been observed in some animal studies.

The effect of radiation depends on the amount absorbed. Temporary effects such as vomiting might be caused by an instantaneous dose of 100-200 rem (1-2 Sv), but with no long-lasting side effects. At 50 rem (0.5 Sv) a single instantaneous dose might cause a reduction in white blood cell count. The West Valley Demonstration Project work force is limited to 0.1 rem (1 mSv) for individual daily work exposures, not to exceed 1 rem (10 mSv) per calendar quarter. At such low exposures no clinically observable effects have ever been seen. The calculated doses from Project operations for the maximally exposed off-site individual is about 0.23 mrem (2.3E-03 mSv).

The difficulty in assessing biological damage from radiation is that other factors can cause the same symptoms as radiation exposure. Moreover, the body apparently is able to repair damage caused by low-level radiation.

The effect most often associated with exposure to relatively high levels of radiation is an increased risk of cancer. However, scientists have not been able to demonstrate that exposure to low-level radiation causes an increase in deleterious biological effects, nor have they been able to determine if there is a level of radiation exposure below which there are no biological effects.

Measuring Radiation at the West Valley Demonstration Project

Human beings may be exposed to radioactivity primarily through air, water, and food. At the West Valley Demonstration Project all three pathways are monitored, but air and surface water pathways are the two major means by which radioactive material can move off-site.

The geology of the site (kinds and structures of rock and soil), the hydrogeology (water presence and flow), and meteorological characteristics of the site (wind speed, patterns,

and direction) are all considered in evaluating potential exposure through the major pathways.

The West Valley Demonstration Project Monitoring Program

The on-site and off-site monitoring program at the West Valley Demonstration Project includes measuring the concentration of total alpha and beta radioactivity, conventionally referred to as "gross alpha" and "gross beta," in air and water effluents. Measuring the total alpha and beta radioactivity in several samples, which can be done within a matter of hours, produces a comprehensive picture of current on-site and off-site radiation levels from all sources. In a facility such as the West Valley Demonstration Project, tracking the overall levels of radioactivity in effluents is an important tool in maintaining acceptable operations.

Other radioactive parameters are measured as well. Strontium-90 and cesium-137 are measured because of their relative abundance in WVDP waste streams. Radiation from certain important radionuclides such as tritium or iodine-129 are not sufficiently energetic to be detected with the gross beta measurements, so these must be analyzed separately with instruments having greater sensitivity. Heavy elements such as uranium require special analysis to be detected because they exist at such low levels at the WVDP.

The radionuclides monitored at the Project are those that might produce relatively higher doses or that are most abundant in the air and water effluents. Because sources of radiation at the Project have been decaying for more than fifteen years, the monitoring program does not routinely include short-lived radionuclides, i.e., isotopes with a half-life of less than two years. (See Appendix A for a schedule of samples and radionuclides measured and Appendix B for related Department of Energy protection standards.)

Data Reporting

Because any two samples are never exactly the same, statistical methods are used to decide how a particular measurement com-

compares with other measurements of similar samples. The term *confidence level* is used to describe how certain a measurement is of being a "true" value. The WVDP environmental monitoring program uses the 95% confidence level, which means that 95% of the measurements (19 out of 20) are within the calculated uncertainty range.

The *uncertainty range*, related to the confidence level, is the expected range of values that account for background nuclear decay and small measurement process variations for which a measurement will be "true" 95% of the time. The uncertainty range, expressed as a "+/-" followed by a value (e.g., 5.30 +/- 3.6E-09 μ Ci/mL) means that the "true" value will be found 95% of the time within the uncertainty range (e.g., from 1.7 to 8.9E-09 μ Ci/mL). If the uncertainty range is greater than the value itself, the measurement is below the "detection limit," which means that at least 95% of the time the "true" value is somewhere below the detection limit value.

1990 Activities at the West Valley Demonstration Project

High-level Waste Processing

- The Integrated Radwaste Treatment System (IRTS)

The high-level radioactive waste (HLW), a by-product of the spent nuclear fuel reprocessing conducted at the site during the late 1960s and early 1970s by Nuclear Fuel Services, Inc., is currently isolated underground in two steel tanks that are contained within concrete vaults.

Approximately 98% of the waste is in one of the tanks (tank 8D-2). The waste has settled into two layers: a liquid phase, the supernatant, and a precipitate layer on the bottom of the tank, the sludge. The total radioactivity in the tank is about equally divided between the supernatant and the sludge.

The supernatant is composed mostly of sodium and potassium salts dissolved in water;

the sludge is composed mostly of iron hydroxide. Radioactive cesium in solution accounts for more than 99% of the total fission products in the supernatant and strontium-90 accounts for most of the radioactivity in the sludge.

The integrated radioactive waste treatment system (IRTS), which began operating in 1988, is a four-step process that reduces the volume of the high-level waste fluids by producing low-level waste stabilized in cement. The IRTS removes more than 99.9% of the radioactivity from the high-level waste fluid, concentrates the resulting low-level liquid waste, blends it with cement, and stores it in 71-gallon square steel drums in an above-ground, shielded vault. More than 272,000 gallons of liquid high-level waste were processed in 1990, and approximately 3800 drums were produced, bringing the total number to about 10,300 drums.

THE SUPERNATANT TREATMENT SYSTEM (STS), housed in a spare storage tank (tank 8D-1) identical to the tank that stores most of the high-level waste, passes the supernatant through four ion-exchange columns filled with zeolite, a synthetic, granular clay material that removes most of the radioactive cesium from the supernatant. The low-level salt solution that remains is sent to the liquid waste treatment system (LWTS) through triple-walled piping. The cesium-loaded zeolite is being stored in tank 8D-1 until the high-level waste vitrification process begins.

THE LIQUID WASTE TREATMENT SYSTEM (LWTS) concentrates the low-level liquid salt solution through evaporation. The liquid is heated and the resulting steam is collected, condensed, and processed before being released as liquid effluent. The radioactive concentrates are then sent to the cement solidification system (CSS).

THE CEMENT SOLIDIFICATION SYSTEM (CSS) blends the radioactive concentrates with cement. This cement/waste mixture is placed in 270-liter (71-gallon) lined, square steel drums that are then stored in a specially designed above-ground shielded vault, the drum cell.

THE DRUM CELL, designed to store Class B and Class C low-level waste, was completed in 1987. It is located southwest of the main plant near the NRC-licensed disposal area (NDA). The drum cell can store approximately twenty thousand 270-liter drums of cement-stabilized low-level waste.

Low-level Waste Processing

- Aqueous Waste

Throughout 1990 the low-level waste treatment facility (LLWTF) processed aqueous wastes before discharge. In 1990 the Project released 42 million liters (11.1 million gallons) to the environment. The discharge waters contained an estimated 46 millicuries (mCi) of radioactivity (gross alpha plus gross beta). Comparable releases during the previous five years, 1985 through 1989, averaged about 44 mCi per year. The 1990 release was roughly 5% above this level.

The 4.42 curies of tritium released in 1990 was a factor of 2.3 above the previous five-year average, primarily as a result of the liquid waste treatment system operation.

- Solid Waste

Contaminated equipment and hardware from NFS operations, as well as contaminated wastes generated by current Project operations, are collected, analyzed, packaged, and stored on-site. When appropriate, metal objects such as piping and tanks are cut up and compressible wastes are compacted to reduce the waste volume. Approximately 37,000 cubic feet of low-level waste was processed in 1990 using compaction and cutting to achieve a 75% reduction in volume. About 53,500 cubic feet of low-level waste in addition to the IRTS drums was collected and placed in storage during 1990. All Project low-level waste is being stored in above-ground facilities. Two additional temporary weatherproof structures were erected in 1990 and will provide more than 50,000 square feet of storage space for packaged low-level waste.

Hazardous Wastes

Nonradioactive hazardous materials used in various site maintenance, cleanup, and testing activities also are subject to safety and regulatory requirements. Hazardous waste management activities in 1990 included building a new storage facility to segregate hazardous materials, installing a new computer program to track on-site hazardous materials, and adding National Fire Protection Association labels to all hazardous material containers.

The Project's hazardous waste management also included new warehouse facilities used to prepare hazardous wastes for off-site transportation; installing four specially engineered steel storage lockers meeting all state and EPA requirements for storage of containerized hazardous waste; establishing a hazardous materials transportation group to manage all hazardous materials shipments; and conducting approximately 4,000 hours of training in hazardous waste operations for 370 employees.

Waste Minimization Program

The draft waste minimization plan for the West Valley Demonstration Project, prepared in accordance with DOE Order 5400.1, provides a basis for long-range planning for waste storage and processing facilities, manpower, funding, and waste minimization activities at the WVDP.

Objectives of the plan include careful segregation of clean materials from contamination zones and reuse of contaminated tools whenever practicable. Waste minimization policy also includes supercompaction of waste, size-reduction, and pretreatment of high-level waste fluids to reduce the volume of material requiring vitrification.

The Project's waste minimization program calls for reducing sources of waste by requiring justification for purchase and use of industrial chemicals and by providing active recycling and treatment of hazardous wastes to make them nonhazardous, where possible. Industrial nonhazardous waste is minimized by recycling certain waste streams and by placing

surplus material at auction or into Government Services Administration surplus.

Pollution Prevention Awareness Program

The West Valley Demonstration Project pollution prevention awareness program includes the right-to-know communications program and new employee orientation that provides information about the WVDP's Industrial Hygiene and Safety Manual, the Environmental Pollution and Control Procedure, and the Hazardous Waste Management Plan.

The pollution prevention awareness program is an integral part of the overall waste minimization program. However, it is a discrete program implemented by all operational groups in the WVDP and is supported by the Training and Development department.

The full pollution prevention awareness program eventually will include all-employee meetings, video screenings, posters, contests and awards, and a Pollution Prevention Awareness Day.

National Environmental Policy Act (NEPA) Activities

The eventual goal of the West Valley Demonstration Project is not only to convert high-level waste into stabilized waste forms (Phase I) but to also decontaminate and decommission the facilities used in the Project in a manner that will ensure the safety of the environment and the public (Phase II). Phase I activities generally concern the day-to-day operations that support solidifying the high-level waste.

Phase I NEPA Activities

During 1990 thirty-nine Environmental Checklists documenting proposed WVDP actions were submitted as categorical exclusions for Department of Energy review and approval. (A categorical exclusion is defined as a category of action that normally does not individually or cumulatively have a significant effect on the quality of the human environment

and that requires neither an environmental impact statement nor an environmental assessment). Before memoranda-to-file were discontinued in September 1990, the WVDP received approvals for three on-site activities that had been submitted for approval as memoranda-to-file.

Phase II NEPA Activities: Site Characterization

Before the Department of Energy can move from Phase I activities to Phase II closure activities another environmental impact assessment must be produced. Initial steps toward this goal include intensive characterization of the site in order to provide an estimate of the environmental effects of closure activities.

Existing site and waste data were collected and reviewed, and more than one thousand historical documents were indexed. Field activities included an overland gamma survey, surface soil sampling at selected solid waste management units (SWMUs), preliminary sediment sampling of Lagoons 2 and 3, and data collection and analysis of the geohydrology of the site, geochemistry and water quality, air quality, and the distribution of radiological and hazardous contaminants. Contaminant transport modeling also was evaluated as well as the cultural and ecological resources of the site and its environs.

Although a significant portion of the preliminary work for the Phase II site characterization had been completed in 1989 and 1990, budgetary cutbacks necessitated a change in the pace of work on the environmental impact statement (EIS) site characterization. However, compliance monitoring under the Resource Conservation and Recovery Act (RCRA) continues to retain its high priority.

The WVDP is currently negotiating a 3008(h) Order on Consent and a Federal and State Facilities Compliance Agreement (FSFCA) with the U.S. Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation with respect to Resource Conservation and Recovery Act (RCRA) guidelines and their implementation at the WVDP.

The Consent Order and the Federal and State Facilities Compliance Agreement requires that the site conduct investigations and develop plans and schedules that comply with RCRA guidelines. Since these negotiations and compliance agreements had been anticipated, much of the 1990 site characterization work also satisfied these future needs.

In order to satisfy RCRA guidelines and decelerate the environmental impact statement program, work during 1990 and 1991 has focused on the solid waste management units.

1990 Changes in the Environmental Monitoring Program

Several changes were made in the routine environmental monitoring program in 1990 as part of a continuing effort to improve existing monitoring points and in response to regulatory changes.

- SPDES Permits and DOE Order 5400.5

The Project's modified SPDES permit expanded monitoring of location WN5P001, the primary point of liquid effluent batch release from the site, to include analyses for several additional chemical parameters. To demonstrate compliance with DOE Order 5400.5, which was effective May 1990, monitoring of sanitary waste sludge from the sewage treatment plant for radiological parameters was added to the program.

- Expanded Monitoring Program

The existing monitoring program was expanded by adding several sampling locations: a new fallout collection point on-site, new locations for collection of site drinking water, and an underdrain collection point to better monitor subsurface drainage in the high-level waste storage and processing area. Additional analyses of samples from existing locations — tritium analysis of beef and deer samples and uranium analysis of selected soil samples — were added in the 1990 program. And rather than sampling half of the private residential

drinking water wells every year, all are now sampled annually.

One on-site surface water monitoring point was upgraded for automated sample collection. This point monitors surface waters draining from the lag storage area, where additional waste storage buildings have been added and elevated monitoring needs are anticipated. (See Appendix A for details of the above changes. Although not noted in Appendix A, new on-site groundwater monitoring wells installed in 1990 were sampled during the year during the well development phase. Results are not included in this report because the sampling was only preliminary.)

RCRA Reports

WVNS has developed a hazardous waste management plan that ensures proper management of all hazardous waste from the point of generation to final disposition. The plan's basic requisites include properly designating and packaging all hazardous waste generated at the facility; obtaining appropriate samples and characterizing wastes according to hazardous wastes regulations; maintaining required records and reports; stocking and maintaining spill control materials and equipment and ensuring that the appropriate employees are trained in emergency response; and determining nonradioactive hazardous waste release reporting and notification requirements and, when required, making appropriate notifications.

Toxic Chemical Inventory

Under the Superfund Amendments and Reauthorization Act (SARA) Title III requirements, also known as the Emergency Preparedness and Community Right-to-Know Act (EPCRA), hazardous chemical inventories on-site must be reported to the EPA. During the 1990 reporting period the WVDP produced quarterly updates of the inventory of hazardous chemicals used on-site and sent them to local and state emergency management agencies. The chemicals, quantities stored on-site, and on-site use in 1990 included:

- » ammonia (380 lbs), used in the laboratories and for sewage treatment
- » cement (70,000 lbs), used in the solidification of low-level radioactive waste
- » chlorine (600 lbs), used to disinfect potable water
- » diesel fuel #2 (7000 lbs), used for back-up power for generators
- » ferrous sulfate (32,000 lbs), used in waste water treatment
- » gasoline (16,500 lbs), used for on-site vehicles
- » fuel oil # 2 (7,000 lbs), used for back-up power for boilers and other equipment
- » hydrogen peroxide (1,100 lbs), used in the nitrous oxides off-gas system
- » lithium hydroxide (2,600 lbs), used in vitrification
- » nitric acid (1,200 lbs), used in vitrification testing and for pH control
- » oil (9,000 lbs), used to lubricate various equipment
- » propane (500 lbs), used for fuel
- » silicon dioxide (17,100 lbs), used in vitrification
- » sodium hydroxide (12,400 lbs), used in water treatment
- » sulfuric acid (33,000 lbs), used in water treatment
- » zinc bromide (13,500 lbs), used for radiation shielding in viewing windows

Seven chemicals (12,300 lbs) were deleted from the 1989 list because vitrification testing had been completed and the chemicals had been disposed of, returned to the vendor, or used in various processes.

On-site Environmental Training

The West Valley Nuclear Services Co., Inc. (WVNS) provides a comprehensive program that identifies eligible employees and trains, re-trains, and documents their Occupational Safety and Health Act (OSHA) instruction as required by 29 CFR 1910.120. The WVNS program focuses on the company's responsibility for providing adequate environmental, health, and safety training for all identified employees of the West Valley Demonstration Project.

To date, more than 300 employees have been trained in a site-specific twenty-four hour hazardous waste operations course that was developed in 1990. WVNS also has trained 198 employees to properly respond to spills on-site. In addition, supervisors are briefed on the legal aspects of environmental compliance through an additional eight hours of skills training for supervisors of hazardous waste operations. Specific RCRA-awareness training also was conducted throughout 1990 for the WVDP management.

In October 1990 an eight-hour hazardous waste operations training program was initially offered. This program provides detailed information on hazardous materials management procedures.

To provide pollution prevention awareness for employees, the goals of the waste minimization program have been included in the radiation worker program and the hazardous waste operations courses. Specific employee incentive programs that recognize improvements in waste minimization and pollution prevention will begin in 1991.

Self - Assessment

Assessments concerning environmental compliance and regulations are summarized in the Environmental Compliance Summary above.



Collecting a Composite Water Sample at the Project Boundary

2.0 Effluent and Environmental Monitoring

2.1 Radiological Monitoring

2.1.1 Air Monitoring

Air is monitored at several locations in order to ascertain the effect of Project activities. Samplers are located at points remote from the West Valley Demonstration Project site, at the perimeter of the site, and on the site itself. (See Appendix A, page A-3, for an explanation of the monitoring location codes.)

SAMPLE COLLECTION AND ANALYSIS

Air samples are collected by drawing air through a very fine filter with a vacuum pump. The total volume of air drawn through the sampler is measured and recorded by a meter. The filters trap particles of dust that are then tested in the laboratory for radioactivity. At two locations (AFRSPRD and AFGRVAL) samples are also collected for iodine-129 analysis using activated carbon cartridges. Three of the four perimeter samplers, mounted on towers 4 meters high, maintain an average flow of about 40 L/min (1.5 ft³/min) through a 47-mm glass fiber filter. The remaining perimeter sampler and the four remote samplers operate with the same air flow rate as the three samplers mounted on towers, but the sampler head is set at 1.7 meters above the ground, the height of the average human breathing zone.

Filters from off-site and perimeter samplers are collected weekly and analyzed after a seven-day "decay" period to remove interference from short-lived naturally occurring radioactivity. Gross alpha and gross beta measurements of each filter are made using a low-background gas proportional counter.

In addition, quarterly composites consisting of thirteen weekly filters from each sample station are analyzed. A complete tabulation of these stations is given in Tables C-2.12 through C-2.20 in Appendix C-2.

The exhaust from each permitted fixed ventilation system serving the site's facilities is continuously filtered, monitored, and sampled as it is released to the atmosphere. Specially designed isokinetic sampling nozzles continuously remove a representative portion of the exhaust air, which is then drawn through very fine, small, glass fiber filters to trap any particles. Sensitive detectors continuously measure the radioactivity on these filters and provide remote readouts of alpha and beta radioactivity levels to control display panels.

A separate sampling unit on the ventilation stack of each system contains another filter that is removed every week and subjected to additional laboratory testing. This sampling system also may contain an activated carbon cartridge used to collect a sample that is analyzed for iodine-129.

In addition to these samples, water vapor from the main plant ventilation stack (ANSTACK) is collected by trapping moisture on silica gel desiccant columns. The trapped water is distilled from the silica gel desiccant and analyzed for tritium.

Because tritium, iodine, and other isotopic concentrations are quite low, the large-volume samples collected weekly from the main plant stack and from other emission-point samplers provide the only practical means of determining the amount of specific radionuclides released from the facility.

- Perimeter and Remote Air Sampling

In 1990 airborne particulate radioactive samples were collected continuously at five locations around the perimeter of the site and at four remote locations at Great Valley, West Valley, Springville, and at Dunkirk, New York (Fig. 2-1).

The choice of the perimeter locations — on Fox Valley Road, Rock Springs Road, Route 240, Thomas Corners Road, and Dutch Hill Road — was based either on historical continuity or the highest probable annual average airborne concentrations.

The remote locations provide data from nearby communities — West Valley and Springville — and from natural background areas. Concentrations measured at Great Valley (AFGRVAL, 29 km south of the site) and Dunkirk (AFDNKRK, 50 km west of the site) are considered representative of natural background radiation. Data from these samplers are provided in Appendix C-2, Tables C-2.12 through C-2.20.

- Global Fallout Sampling

Global fallout is also sampled at four of the perimeter air sampler locations and at the base of the meteorological tower on-site. Precipitation from open pots at all of the locations is collected and analyzed every month. Results from these measurements are reported in nCi/m² per month for gross alpha and gross beta and in $\mu\text{Ci/mL}$ for tritium. The 1990 data from these analyses are found in Appendix C-2, Table C-2.21. The pH measurements for precipitation are found in Table C-2.22.

These collections indicate short-term effects, and the reporting units for alpha/beta indicate a rate of deposition rather than the actual concentration of activity within the collected water. Long-term deposition is measured by surface soil samples collected annually near each sampling station. Soil sample data are found in Table C-1.11 of Appendix C-1.

RADIOACTIVITY CONCENTRATIONS AT PERIMETER AND REMOTE LOCATIONS

The average monthly concentrations at the perimeter and remote locations ranged from $8.84\text{E-}15 \mu\text{Ci/mL}$ to $8.45\text{E-}14 \mu\text{Ci/mL}$ ($3.3\text{E-}4 \text{Bq/m}^3$ to $3.1\text{E-}3 \text{Bq/m}^3$) of beta activity and from $5.2\text{E-}16 \mu\text{Ci/mL}$ to $3.80\text{E-}15 \mu\text{Ci/mL}$ ($1.9\text{E-}5 \text{Bq/m}^3$ to $1.4\text{E-}4 \text{Bq/m}^3$) of alpha activity. Iodine-129 was not detected at either the Rock Springs Road location (AFRSPRD) or the Great Valley location (AFGRVAL), as shown in Tables C-2.13 and C-2.18 in Appendix C-2.

In all cases, the measured monthly gross activities were well below $3\text{E-}12 \mu\text{Ci/mL}$ ($1.1\text{E-}1 \text{Bq/m}^3$) beta and $2\text{E-}14 \mu\text{Ci/mL}$ ($7.4\text{E-}4 \text{Bq/m}^3$) alpha, the most stringent acceptable limits (referred to as derived concentration guides, or DCGs) set by the Department of Energy for any of the isotopes present at the WVDP. (Department of Energy standards and DCGs for radionuclides of interest at the West Valley Demonstration Project can be found in Appendix B.)

Annual data for the three samplers that have been in operation since 1983 average about $1.84\text{E-}14 \mu\text{Ci/mL}$ ($6.8\text{E-}04 \text{Bq/m}^3$) of gross beta activity in air. This average is comparable to 1990 data. The average gross beta concentration at the Great Valley background station was $2.04\text{E-}14 \mu\text{Ci/mL}$ ($7.5\text{E-}04 \text{Bq/m}^3$) in 1989, and in 1990 averaged $1.65\text{E-}14 \mu\text{Ci/mL}$ ($6.1\text{E-}04 \text{Bq/m}^3$).

ON-SITE VENTILATION SYSTEMS

- The Main Plant Ventilation Stack (ANSTACK)

The main ventilation stack (ANSTACK) sampling system remained the most significant airborne effluent point in 1990. A high sample collection flow rate through multiple intake nozzles ensures a representative sample for both the weekly filter sample and the on-line monitoring system. Variations in monthly concentrations of airborne radioactivity reflect the level of Project activities within the facility. (See Appendix C-2, Table C-2.1.) However, at the point of discharge, average radioactivity levels were already below concentration

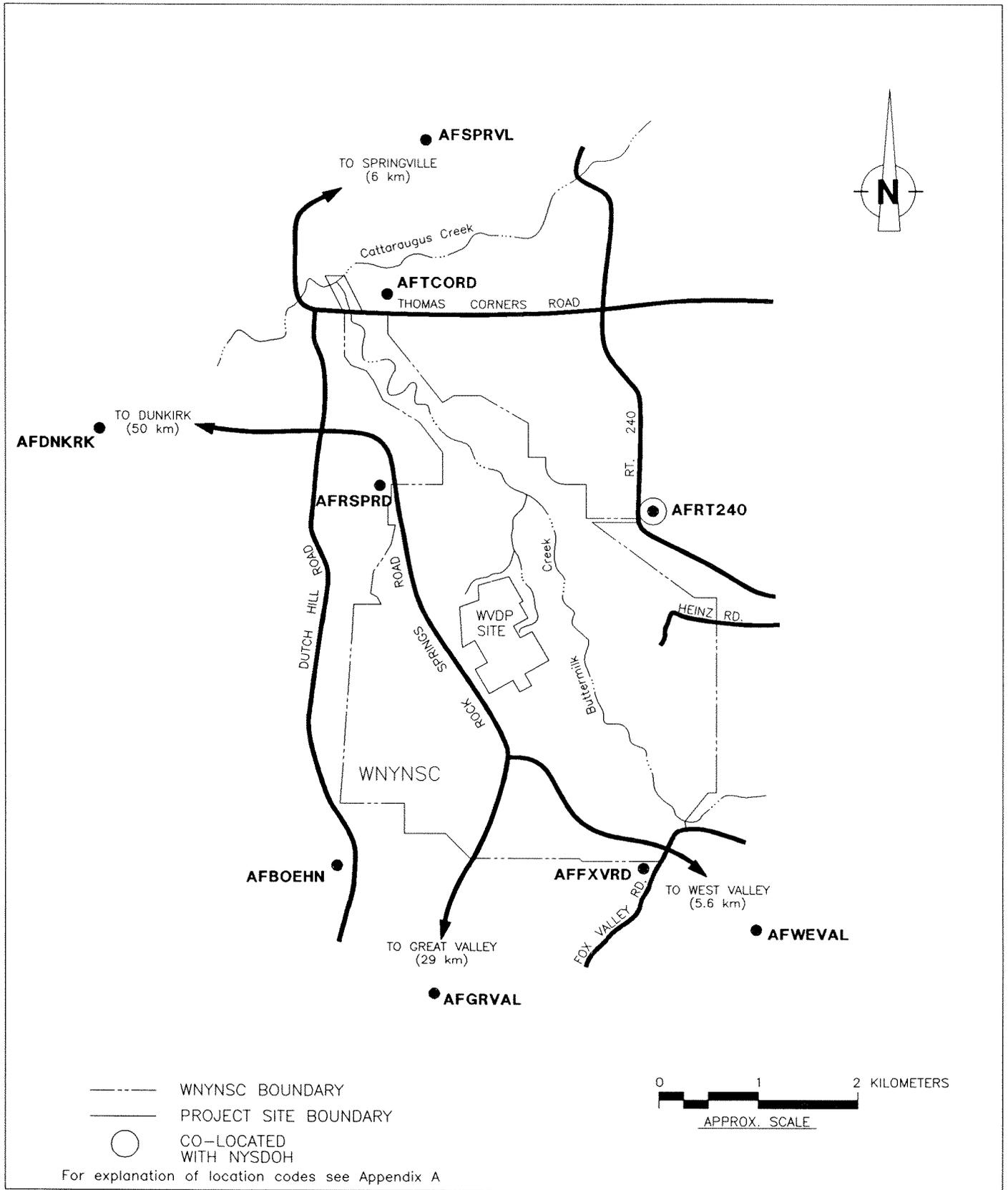


Figure 2-1. Off-Site Air Sampler Locations.

guidelines for airborne radioactivity in an unrestricted environment. (See Appendix C-2, Table C-2.3.) Further dilution from the stack to the site boundary reduces the concentration by an average factor of about 200,000.

The total quantity of gross alpha, gross beta, and tritium released each month from the main stack, based on weekly filter measurements, is shown in Appendix C-2, Table C-2.1. The results of analyses for specific radionuclides in the four quarterly composites of stack effluent samples are listed in Table C-2.2.

- Other On-site Sampling Systems

Sampling systems similar to the main stack system monitor airborne effluents from the cement solidification system ventilation stack (ANCSSTK), the contact size reduction facility ventilation stack (ANCSRFK), and the supernatant treatment system ventilation stack (ANSTSTK). The 1990 samples showed detectable gross radioactivity, including specific beta- and alpha-emitting isotopes, but did not approach any Department of Energy effluent limitations. (See Tables C-2.4 through C-2.9 in Appendix C-2.)

Three other operations are routinely monitored for airborne radioactivity releases: the low-level waste treatment facility ventilation system (ANLLWTF), the contaminated clothing laundry ventilation system (ANLAUNV), and the supercompaction volume reduction ventilation system (ANSUPCV). Results of monitoring of the supercompaction volume reduction system are found in Tables C-2.10 and C-2.11 in Appendix C-2.

The total amount of radioactivity discharged from facilities other than the main ventilation stack is less than 1% of the airborne radioactivity released from the site and is not a significant factor in the airborne pathway in 1990.

During the early summer of 1990, ANSTACK, ANSUPCV, ANCSSTK, ANSTSTK, and ANCSRFK were flow-tested by an outside contractor. The testing was designed to assess the efficiency of flow and transport through the sampling lines by injecting a known quantity of various extremely small particulates at

the intake nozzle and measuring the amount and size of the particles that were carried through to the air monitoring instruments. The data are now being evaluated to determine if sampling flow rate or minor design changes should be made.

2.1.2 Surface Water and Sediment Monitoring

SAMPLE COLLECTION

Four automatic samplers collect surface water at points along drainage channels within the WNYNSC. Water collection points were chosen at locations most likely to show any radioactivity released from the site and at a background station upstream of the site.

The samplers draw water through a tube extending to an intake below the stream surface. An electronically controlled battery-powered pump first blows air through the sample line to clear any debris. The pump then reverses to collect a sample, reverses again to clear the line, then resets itself. The pump and sample container are housed in a small insulated and heated shed to allow sampling throughout the year.

- Off-site Surface Water Sampling

An off-site sampler (WFFELBR) is located on Cattaraugus Creek at Felton Bridge just downstream of the confluence with Buttermilk Creek, the major surface drainage from the Western New York Nuclear Service Center (Fig. 2-2). The sampler periodically collects an aliquot (a small volume of water, approximately 100 mL/hour) from the creek. A chart recorder registers the stream depth during the sampling period so that a flow-weighted weekly sample can be proportioned into a monthly composite based on relative stream discharge. Gross alpha, beta, and tritium analyses are performed each week, and the composite is analyzed for strontium-90 and gamma-emitting isotopes.

In addition to the Cattaraugus Creek sampler, two surface water monitoring stations are located on Buttermilk Creek. Samplers collect water from a background location upstream of the Project (WFBCBKG) and from a location at Thomas Corners Road downstream of the

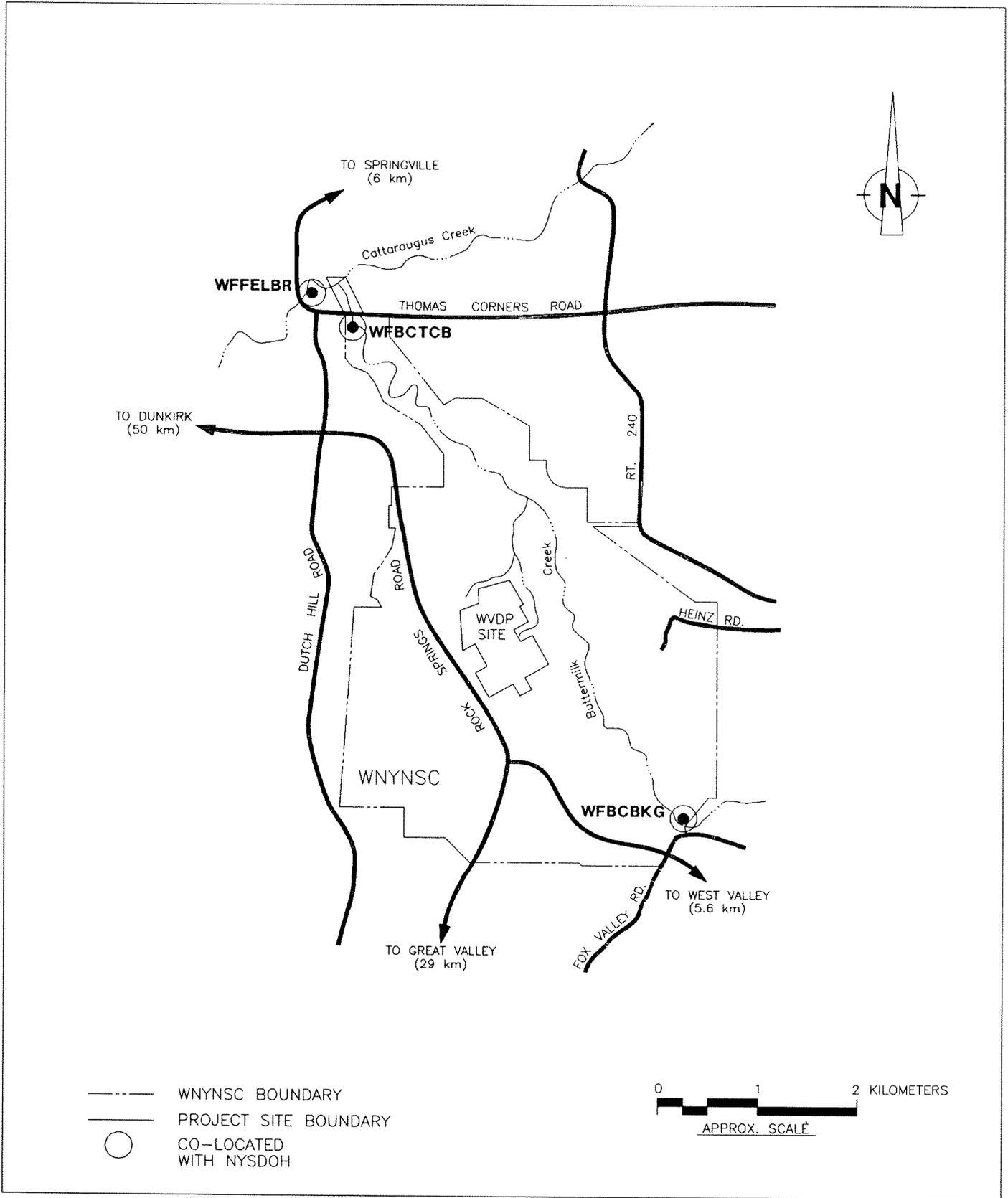


Figure 2-2. Off-Site Surface Water Sampling Locations.

plant and upstream of the confluence with Cattaraugus Creek (WFBCTCB). The samplers collect a 25-mL aliquot every half-hour. Samples are retrieved biweekly, composited monthly, and analyzed for tritium, gross alpha, and gross beta radioactivity. A quarterly composite of the biweekly samples is analyzed for gamma-emitting isotopes and strontium-90.

The fourth station (WNSP006) is located on Frank's Creek where Project site drainage leaves the security area (Fig. 2-3). This sampler collects a 50-mL aliquot every half-hour. Samples are retrieved weekly and composited both monthly and quarterly. Weekly samples are analyzed for tritium and gross alpha and beta radioactivity. The monthly composite is analyzed for strontium-90 and gamma-emitting isotopes. A quarterly composite is analyzed for carbon-14, iodine-129, and alpha-emitting isotopes.

Tabulated data from surface water samplers are provided in Appendix C-1, Tables C-1.3 through C-1.7.

- On-site Surface Water Sampling

The largest single source of radioactivity released to surface waters from the Project is the discharge from the low-level waste treatment facility (LLWTF) through the Lagoon 3 weir (WNSP001, Fig. 2-3) into Erdman Brook, a tributary of Frank's Creek. There were four batch releases totaling about 42 million liters in 1990. The effluent was grab-sampled daily during the forty-four days of release and analyzed. The total amounts of radioactivity in the effluent are listed in Table C-1.1. Of the activity released, 0.8% of the tritium and 2.1% of the other gross radioactivity originated in the New York State-licensed disposal area (SDA), based on measurements of water transferred in 1990 from the SDA to the low-level waste treatment facility, and not from previous or current Project operations (see Table C-1.10 in Appendix C-1). The annual average concentrations from the Lagoon 3 effluent discharge weir, including all measured isotope fractions, were less than 30% of the DCGs (Table C-1.2 in Appendix C-1). Provisional results of isotopic uranium inves-

tigations of U-232 are reported in Table C-1.1 for Lagoon 3 releases. If these tentative values were normalized for 1990 liquid effluents, the releases would be 86% of the DCGs but would not affect the doses to the public.

RADIOACTIVITY CONCENTRATIONS AT OFF-SITE WATER SAMPLE LOCATIONS

Radiological concentration data from these sample points show that average gross radioactivity concentrations generally tend to be higher in Buttermilk Creek below the WVDP site, presumably because small amounts of radioactivity from the site enter Buttermilk Creek via Frank's Creek. The range of gross beta activity, for example, was from $< 1.7E-9$ to $5.9E-9 \mu\text{Ci/mL}$ ($< 6.3E-2$ to $2.2E-1 \text{ Bq/L}$) upstream in Buttermilk Creek at Fox Valley (WFBCBKG), and from $2.9E-9$ to $1.2E-8 \mu\text{Ci/mL}$ ($1.1E-1$ to $4.4E-1 \text{ Bq/L}$) in Buttermilk Creek at Thomas Corners Bridge (WFBCTCB). (See Tables C-1.3 and C-1.4.) Concentrations downstream of the site are only marginally higher than background concentrations upstream of the site. Yearly averages for Cattaraugus Creek at Felton Bridge are not significantly higher statistically than background levels.

In comparison, if the maximum beta concentration in Buttermilk Creek at Thomas Corners Bridge, to which dairy cattle have access, is assumed to be entirely iodine-129, which is the most restrictive beta-emitting isotope, then the activity represents 2.3% of the Department of Energy's derived concentration guide (DCG) for unrestricted use. (See Appendix B for a list of acceptable concentration limits.) The maximum observed 1990 beta concentration is less than that of 1989 at this location.

At the Project security fence (WNSP008) more than 4 kilometers from the nearest public access point, the most significant beta-emitting radionuclides were measured at $4.1E-8 \mu\text{Ci/mL}$ ($1.5E+00 \text{ Bq/L}$) for cesium-137 and $4.6E-8 \mu\text{Ci/mL}$ ($1.7E+00 \text{ Bq/L}$) for strontium-90 during the period of highest concentration. This corresponds to 1.4% and 4.6% of the DCGs for cesium-137 and strontium-90,

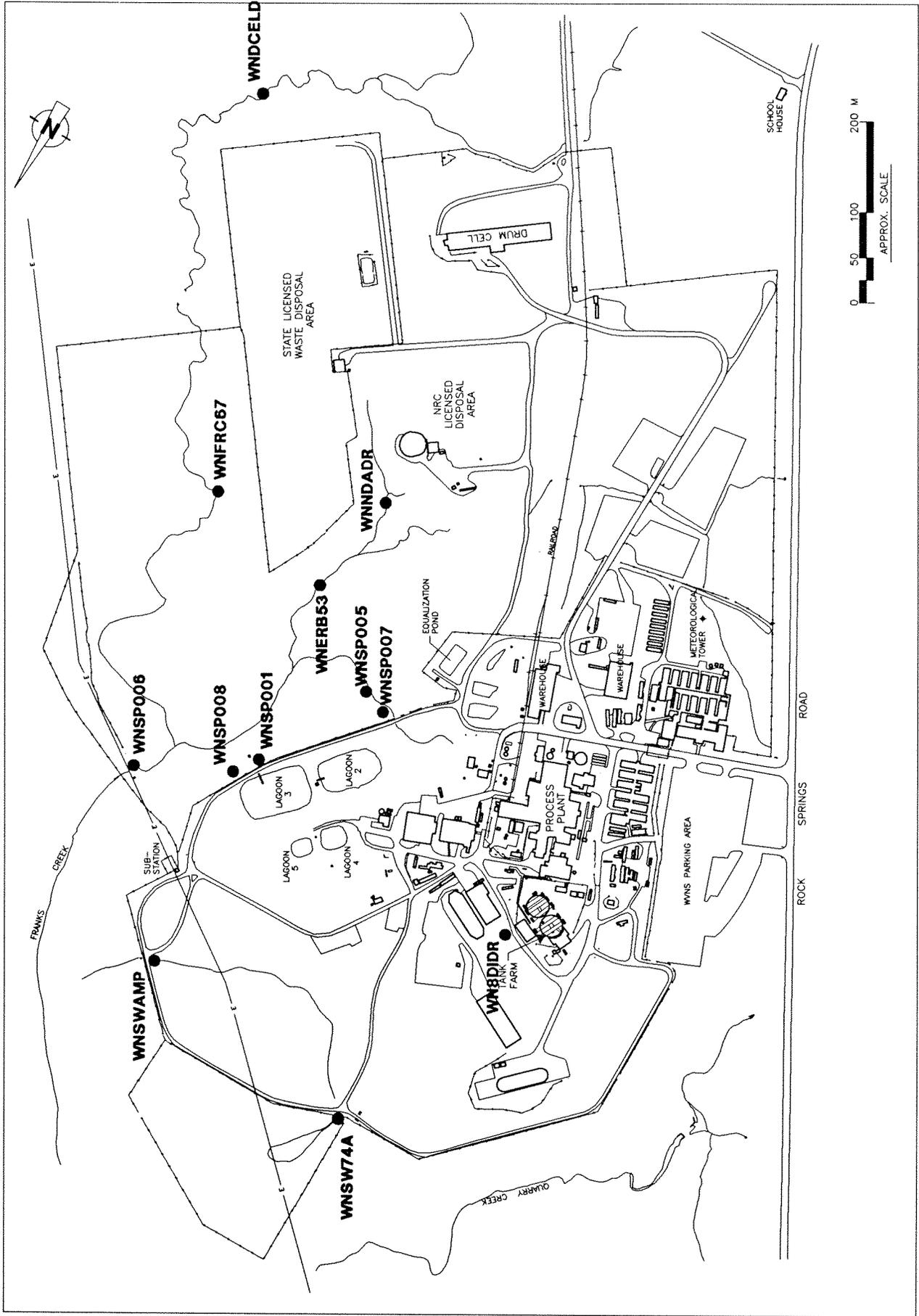
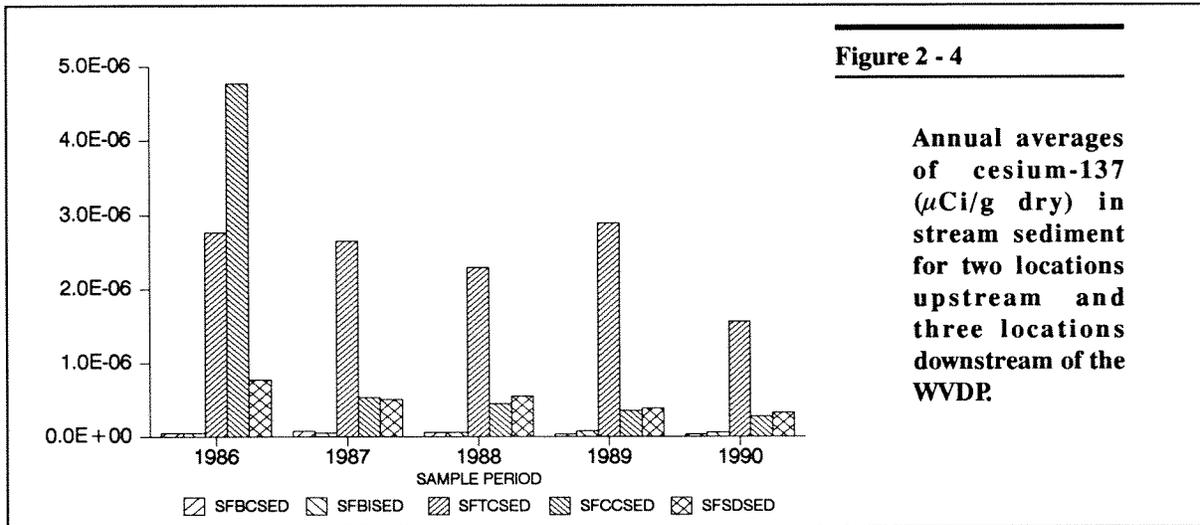


Figure 2-3. On-Site Surface Water Sampling Locations.

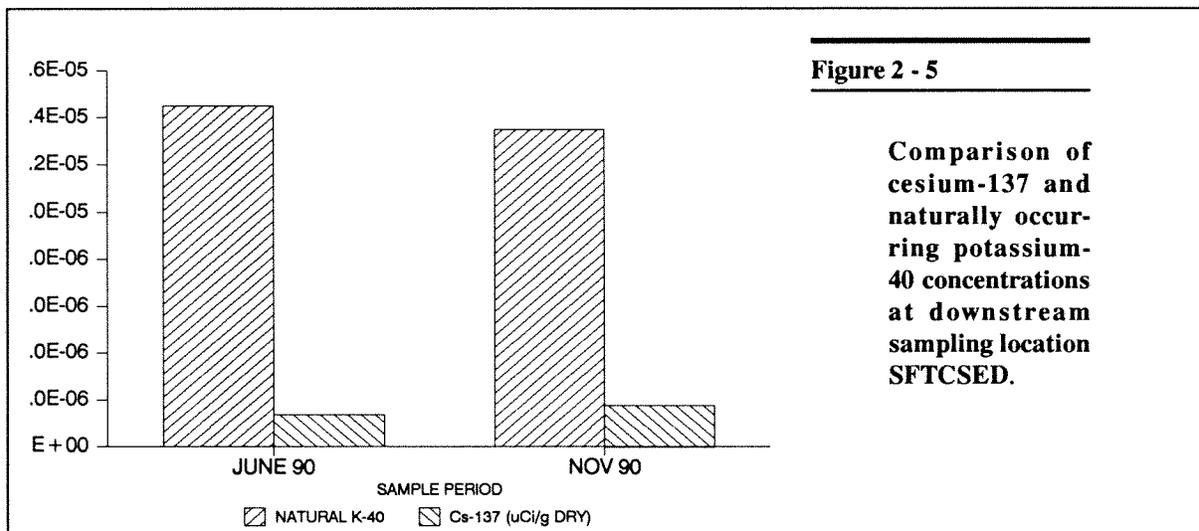


respectively. The annual average was 0.7% for cesium and 2.7% for strontium. Tritium, at an annual average of $4.7\text{E}-6 \mu\text{Ci/mL}$ ($1.7\text{E} + 2 \text{Bq/L}$), was 0.2% of the DCG value. Except for four months of the year, the gross alpha was below the average detection limit of $1.9\text{E}-9 \mu \text{Ci/mL}$ ($6.9\text{E}-2 \text{Bq/L}$), or less than 6.3% of the DCG for americium-241.

The highest concentrations in monthly composite water samples from Cattaraugus Creek during 1990 show strontium-90 to be less than 0.4% of the DCGs for drinking water. No gamma-emitting fuel cycle isotopes were detected in Cattaraugus Creek during 1990 (Table C-1.7).

● Sediment Sampling

Results of sediment sampling from streams upstream and downstream of the Project are tabulated in Appendix C-1, Table C-1.9. A comparison of annual averaged 1986-1990 cesium-137 concentrations for the two upstream locations and the three downstream locations is found in Fig. 2-4. As indicated, cesium-137 concentrations are decreasing or staying constant with time for the locations downstream of the Project (SFTCESED, SFCCSED, and SFDSSED). Concentrations of cesium-137 in upstream locations have remained consistent throughout the time period. A comparison of cesium-137 to naturally occurring potassium-40 (Fig. 2-5) for



the downstream location nearest the Project (SFTCSSED) indicates that cesium-137 is present at levels lower than naturally occurring gamma emitters.

2.1.3 Radioactivity in the Food Chain

Samples of fish and deer were collected near the site and from remote locations during periods when they would normally be taken by sportsmen for consumption. Milk and beef from cows grazing near the site and at remote locations, as well as hay, corn, apples, and beans were collected and analyzed during 1990. Locations of remote background samples are shown on Figure 2-6. The results of these sample analyses are found in Tables C-3.1 through C-3.4.

Fish

Fish samples are analyzed for strontium-90, cesium-134, and cesium-137. (See Table C-3.4 in Appendix C-3). Fish samples were collected semiannually during 1990 above the Springville dam from the portion of Cattaraugus Creek downstream of WNYNSC drainage (BFFCATC). Ten fish were collected from this section of the stream during each semiannual period and the strontium-90 content and gamma-emitting isotopes in flesh were determined. Fish samples (BFFCATD) were also taken from Cattaraugus Creek below the dam, including species that migrate nearly forty miles upstream from Lake Erie. These specimens were representative of sport fishing catches in the drainage downstream of the dam at Springville.

Control samples containing only natural background radiation provided comparisons with the concentrations found in fish taken from site-influenced waters. A similar number of fish were taken from waters that are not influenced by site runoff (BFFCTRL) and their edible portions were analyzed for the same isotopes. These control samples were representative of the species collected in Cattaraugus Creek downstream from the WVDP.

The only statistically significant results were obtained in the first half of 1990, with stron-

tium-90 at concentrations of $1.1E-08 \mu \text{Ci/g}$ (4.1 Bq/kg) wet weight in fish collected below the Springville dam. The background samples averaged $2.8 E-09 \mu \text{Ci/g}$ (1.1 Bq/kg).

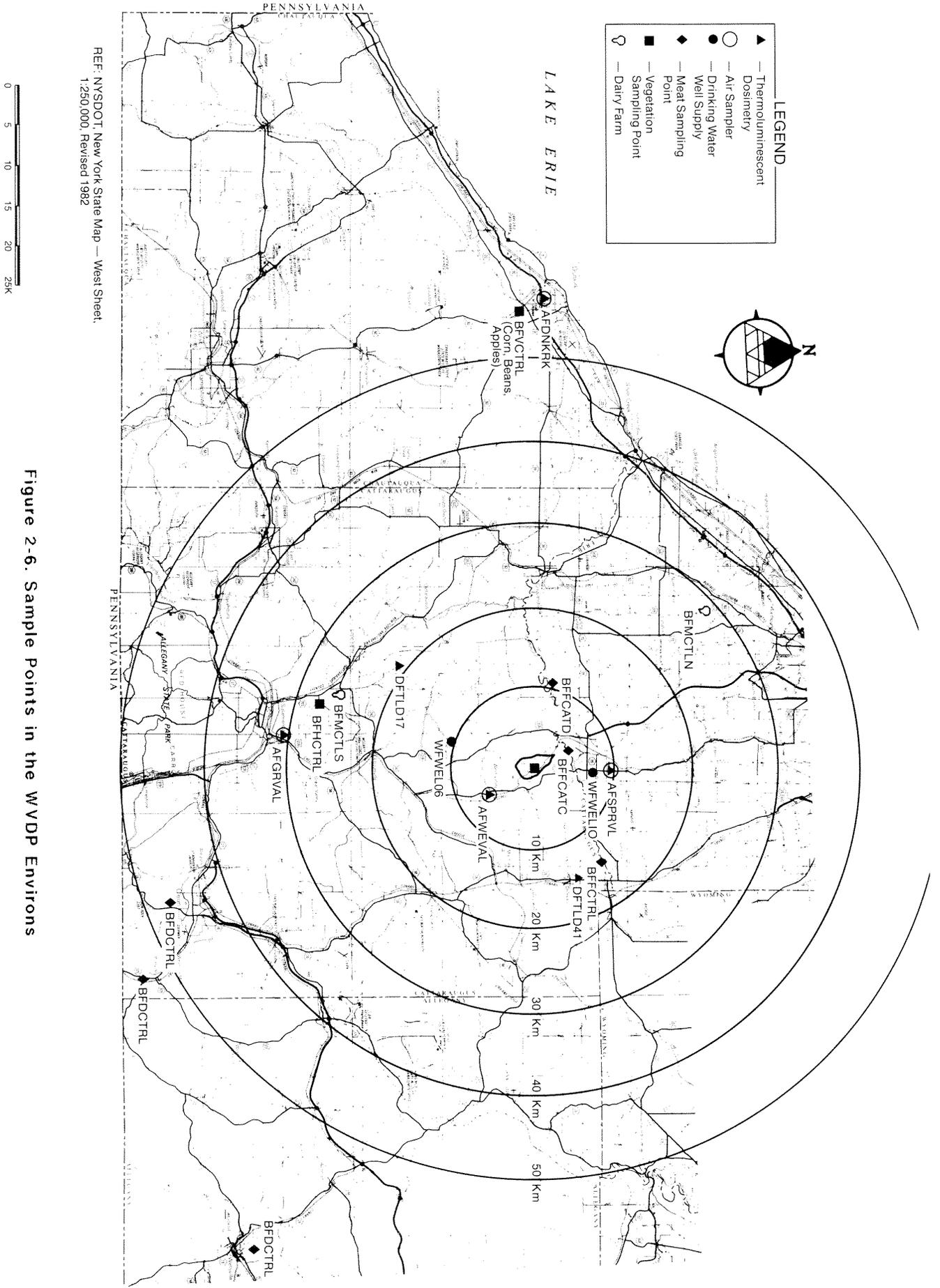
Venison

Specimens from an on-site deer herd were analyzed for radioactive components. (See Table C-3.2 in Appendix C-3). Historically, concentrations of radioactivity in deer flesh have been very low and site activities have not been shown to affect the local herd.

Meat and Milk

The concentration of strontium-90 in beef from the near-site farm appeared to be similar to the control samples. Cesium analysis of both samples yielded detection limit values. Historically, very little difference in isotope concentration has been observed between near-site and control herds.

Milk samples were taken in 1990 from dairy farms near the site (Fig. 2-7) and from control farms at some distance. Besides the quarterly composite sample from the maximally exposed herd to the north (BFMREED), an additional quarterly composite of milk was taken from a nearby herd to the northwest (BFMCOBO). Single samples were taken from herds to the south (BFMWIDR) and the southwest (BFMHAUR). Two samples from control herds (BFMCTLN and BFMCTLS) were also collected as quarterly composites. Each sample or composite was analyzed for strontium-90, tritium, iodine-129, and gamma-emitting isotopes (Table C-3.1). Strontium-90 in samples from near the site ranged from $3.3E-10$ to $6.0E-09 \mu \text{Ci/mL}$ ($1.2E-02$ to $2.2E-1 \text{ Bq/L}$). Iodine was not detected in any samples to the lower limit of detection (LLD) of $9.9E-10 \mu \text{Ci/mL}$ ($3.7E-2 \text{ Bq/L}$). Although tritium values above detection limites were observed in milk samples taken from near-site farms in 1990, higher values were observed in samples taken from distant control locations.



REF: NYS DOT, New York State Map — West Sheet,
1:250,000, Revised 1982

Figure 2-6. Sample Points in the WVPD Environs

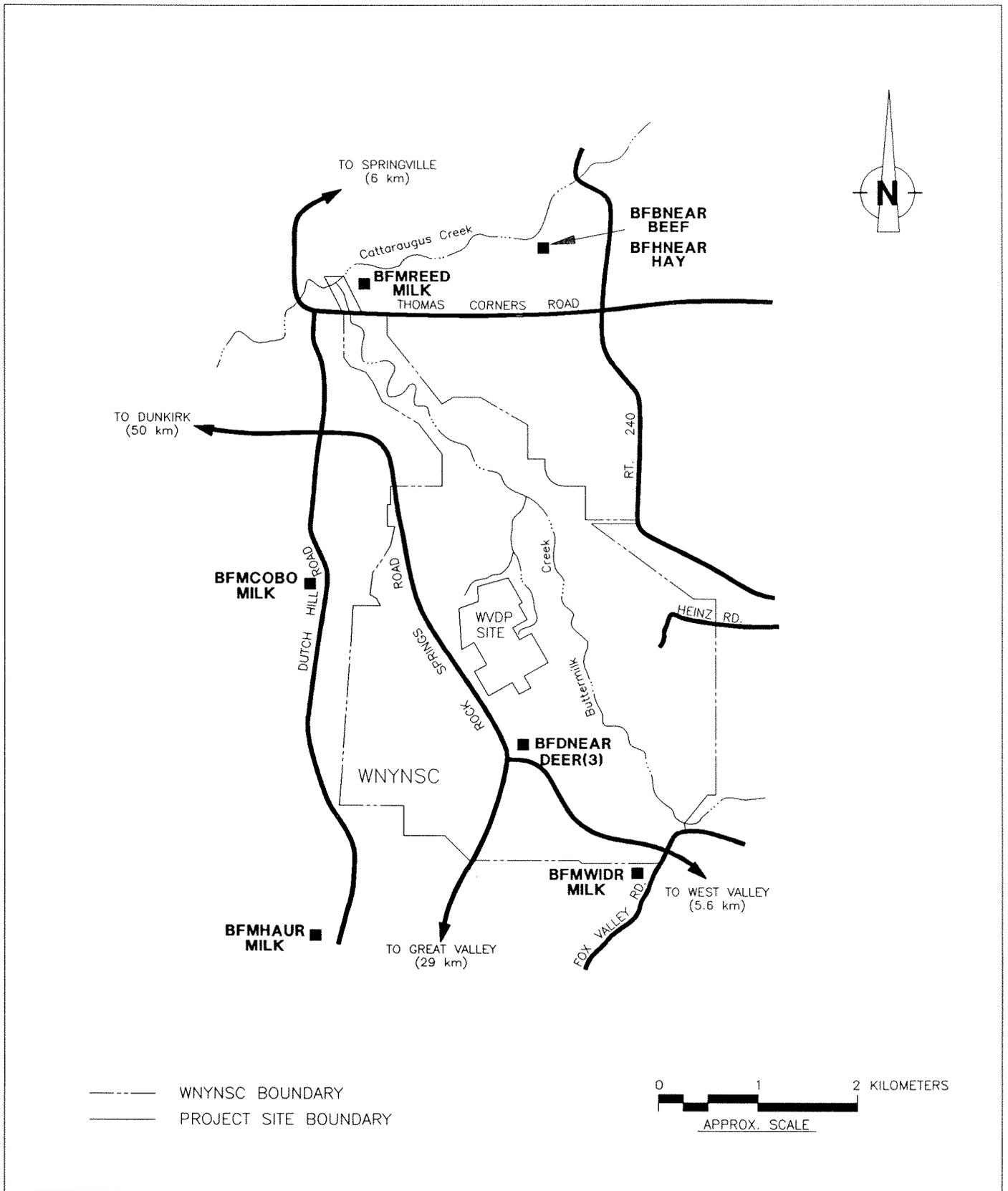


Figure 2-7. Biological Samples Taken Near the WVDP.

Fruit and Vegetables

Based on the samples analyzed in 1990 (Table C-3.3), there were no consistent differences in the concentration of tritium, strontium-90, or gamma-emitting isotopes in corn, beans, or apples grown either near the site or at remote locations.

2.1.4 Direct Environmental Radiation Monitoring

The current monitoring year, 1990, was the seventh full year in which direct penetrating radiation was monitored at the West Valley Demonstration Project using TL-700 lithium fluoride (LiF) thermoluminescent dosimeters (TLDs) located as shown on Figures 2-8, 2-9, and Fig. A-9 in Appendix A. The uncertainty of individual results and averages were acceptable and measured exposure rates were comparable to those of 1989. There were no significant differences in the data collected from the background TLDs (locations 17, 23, 37, and 41) and from those on the WNYNSC perimeter for the 1990 reporting period.

Dosimeters used to measure ambient penetrating radiation during 1990 were processed on-site. The system used Harshaw TL-700 LiF chips, which are used solely for environmental monitoring, apart from the occupational dosimetry TLDs. The environmental TLD package consists of five TLD chips laminated on a thick card bearing the location identification and other information. These cards are placed at each monitoring location for one calendar quarter (three months) and are then processed to obtain the integrated gamma radiation exposure.

Monitoring points are located around the site's perimeter and access road, at the waste management units, at the inner facility fence, and at background locations remote from the WVDP site. Appendix C - 4 provides a summary of the results for each of the environmental monitoring locations by calendar quarter along with averages for comparison.

The quarterly averages and individual location results show very slight differences due to seasonal variation. The data obtained for all

four calendar quarters compared favorably to the respective quarterly data in 1989 with no unusual situations observed. The sixteen perimeter TLD quarterly average was 19.7 milliroentgen (18.9 mrem) in 1990. A comparison of the perimeter TLD quarterly averages since 1983 is shown in Figure 2-10.

- On-site Radiation Monitoring

Presumably because of its proximity to the low-level waste disposal area, the dosimeter at location 19 showed a small elevation in radiation exposure compared to the WNYSC perimeter locations. Although above background, the readings are relatively stable from year to year. Location 25, on the public access road through the site north of the facility, also showed a small elevation above background because decontamination wastes are stored near location 24 within the inner facility fence. (See Appendix C-4, Table C-4.1.)

Location 24 on the north inner facility fence, like Location 19, is not included in the off-site environmental monitoring program; however, it is a co-location site for one NRC TLD (see Appendix D, Table D-7). This point received an average exposure of 0.63 milliroentgens (mR) per hour during 1990, down from 0.67 mR/hour observed in 1989 and 0.79 mR/hr in 1988. Sealed containers of radioactive components and debris from the plant decontamination work are stored nearby and the decrease in exposure rate reflects the radioactive decay of these materials. The storage area is well within the WNYNSC boundary (as is location 19) and is not readily accessible by the public.

TLDs 18 and 32 through 36, all located near the drum cell (storage) building, showed an increase in exposure rate. The average dose rate at these locations was 0.022 mR/hr in 1990, up from 0.015 mR/hr in 1989. This increase reflects the placement in the building of drums containing decontaminated supernatant mixed with cement. The drum cell and the surrounding TLD locations are well within the WNYSC boundary and are not readily accessible by the public.

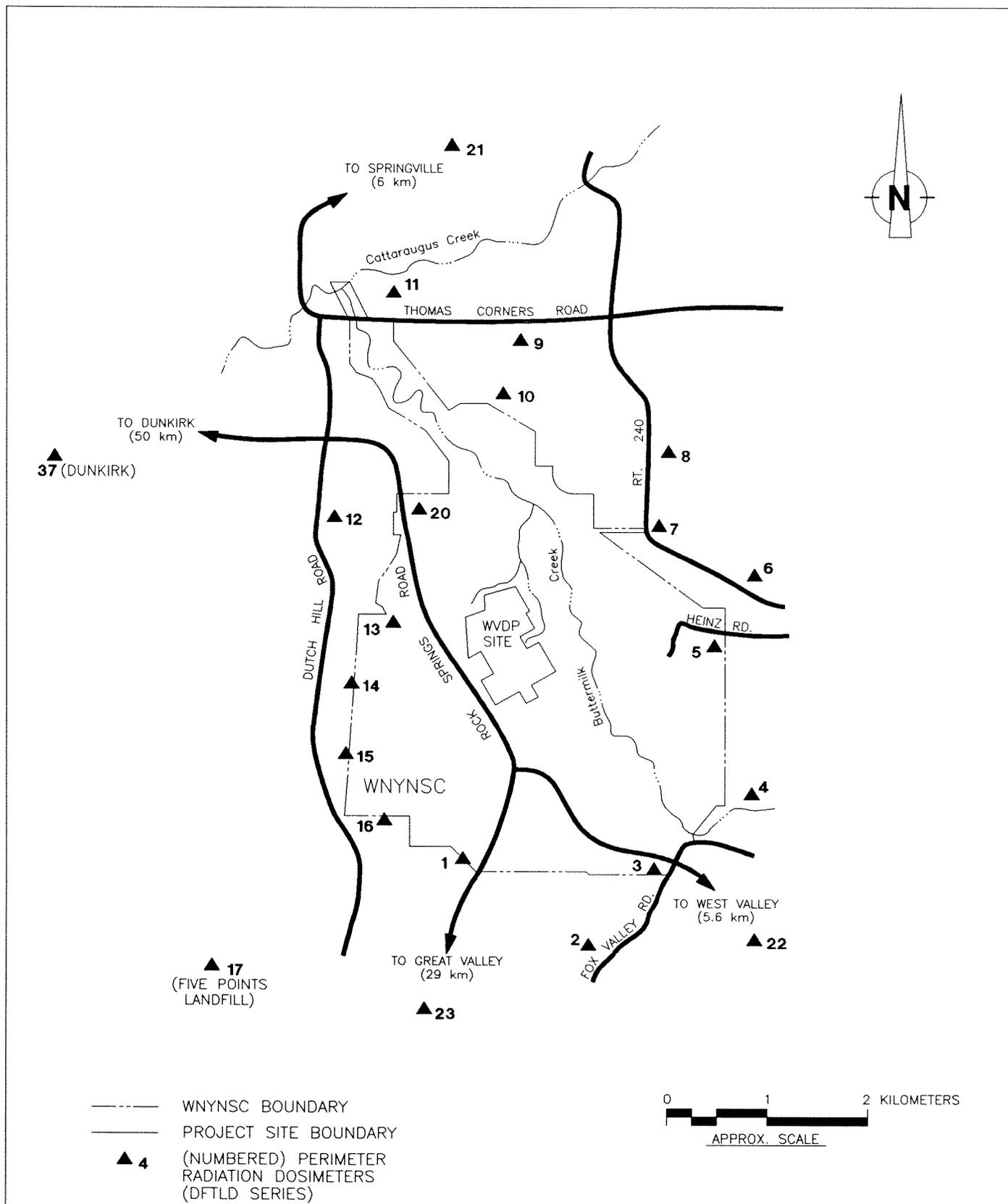


Figure 2-8. Perimeter Thermoluminescent Dosimetry (TLD) Locations.

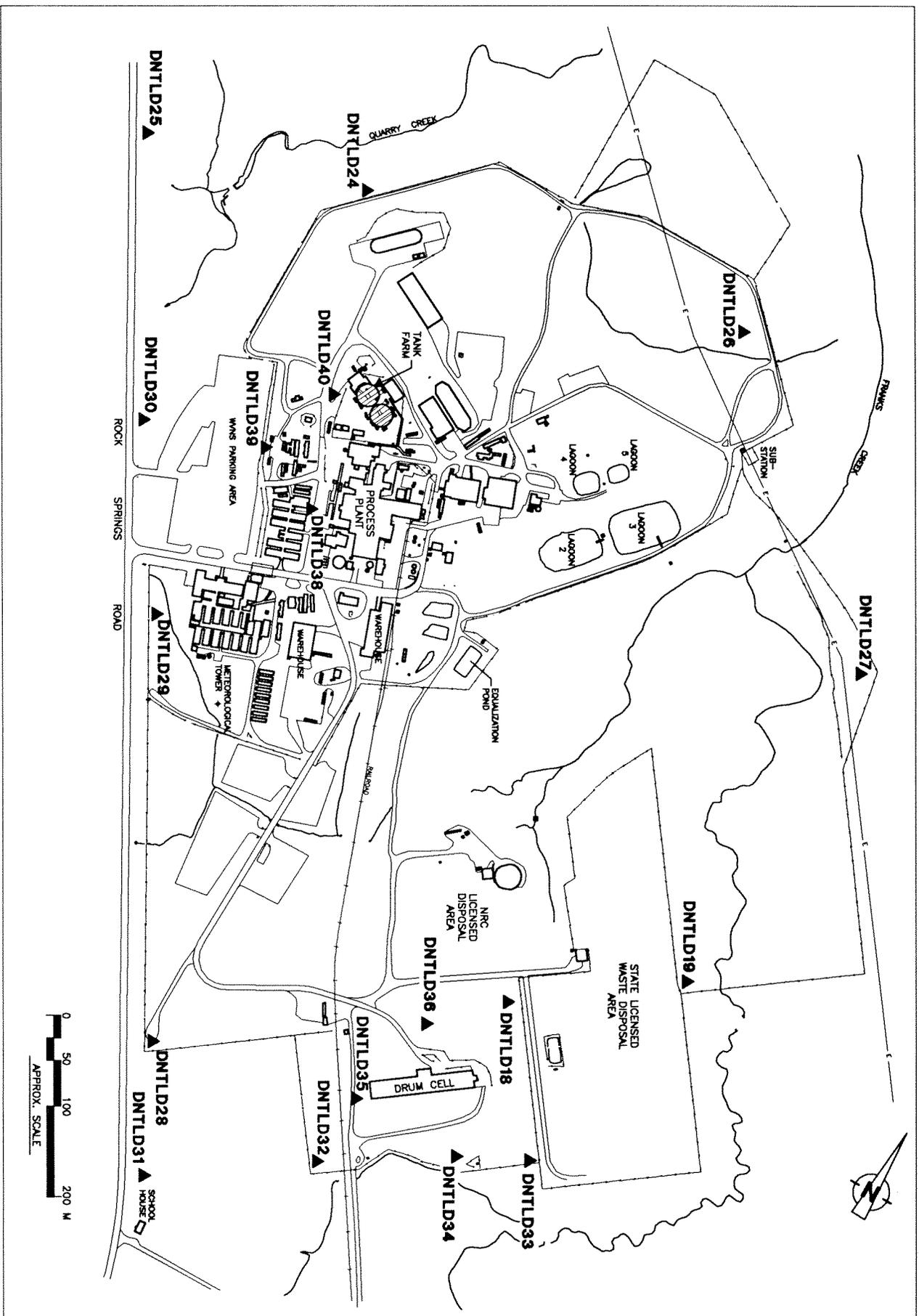


Figure 2-9. On-Site Thermoluminescent Dosimetry (TLD) Locations.

TLD locations 26 through 36 are located along the Project security fence, forming an inner ring of monitoring around the facility area. TLDs 38-40 monitor waste management units and on-site sources.

- Perimeter and Off-site Radiation Monitoring

The perimeter TLDs (1-16 and 20) are located in the sixteen compass sectors around the facility near the WNYNSC boundary. The quarterly averages for these TLDs (Fig. 2-10) indicate no trends other than normal seasonal fluctuations. TLDs 17, 21-23, 37, and 41 monitor background locations. The results from these monitoring points are statistically the same as the perimeter TLDs. Figure C-4.1 in Appendix C-4 shows the TLD location average for off-site TLDs, and Figure C-4.2 shows the location average for on-site TLDs.

2.1.5 Meteorological Monitoring

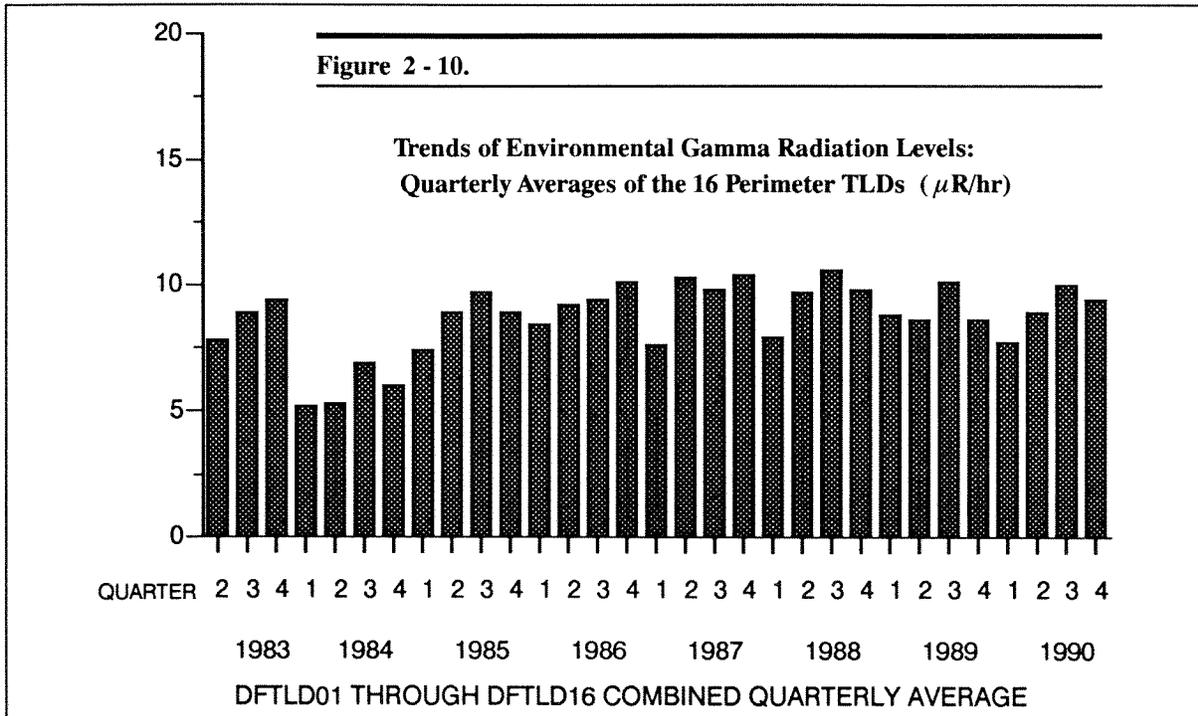
Meteorological monitoring was conducted in 1990 at the WVDP to collect representative and verifiable data that characterize the local and regional climatology of the site. These

data are used to assess potential effects of routine and nonroutine releases of airborne radioactive materials and to calculate dispersion models for any releases that may exceed DOE effluent limits.

Since dispersive capabilities of the atmosphere are dependent upon wind speed, wind direction, and atmospheric stability, which is a function of the difference in temperature between the 10-meter and 60-meter elevations, these parameters are continuously monitored at the WVDP and are available to emergency assessment personnel at all times.

The on-site 60-meter meteorological tower continuously monitors wind speed, wind direction, and temperatures at 60-meter and 10-meter elevations. In addition, an independent, remote 10-meter meteorological tower is located approximately 5 miles south of the site on the top of Dutch Hill Road. This regional tower also continuously monitors wind speed and wind direction at the 10-meter elevation.

The two meteorological towers support the primary digital and analog data acquisition systems located within the Environmental Laboratory. All systems are run on line power



with an uninterruptible power source battery backup in case of site power failure.

Mean wind speed and direction (wind frequency rose) figures for 1990 are found in Figures C-6.1 and C-6.2 in Appendix C-6.

A chart-recording microbarograph is located on-site in the Environmental Laboratory and a digital, tipping-bucket heated precipitation gauge is located near the site meteorological tower.

Cumulative total and weekly total precipitation data is found in Figures C - 6.3 and C - 6.4 in Appendix C - 6. The 1990 total of 53.5 inches of precipitation, which includes snow meltwater equivalent, was considerably higher than the 37.0 inches recorded in 1989. The 1990 totals for the WVDP are about 30% higher than the regional 41-inch precipitation average.

Meteorological information such as meteorological system calibration records, site log books and analog strip charts are archived off-site and are available for evaluation when needed. Meteorological towers and instruments are examined weekly for proper function and calibrated semiannually and/or whenever instrument maintenance might affect calibration.

2.1.6 Special Monitoring

IRTS Drum Cell Radiation Monitoring

During 1990 liquid high-level waste supernatant from tank 8D-2 was processed by the integrated radwaste treatment system (IRTS), which produced 3,850 71-gallon drums of cement-solidified waste. Approximately 6,200 drums were placed in the drum cell before 1990; approximately 10,000 drums are now stored in the drum cell.

Most of the gamma radiation emitted from these drums is shielded by the drum cell walls. Some radiation, however, is emitted through the unshielded roof of the drum cell, scatters in air, and adds to the naturally occurring gamma radiation background levels. Strength of the gamma-ray fields can vary considerably

from day to day and season to season because of changes in meteorological conditions. Variability in background radiation levels depends on factors such as precipitation, solar activity, average temperature, humidity, and barometric pressure.

Radiation exposure levels were monitored both in the drum cell control room and at five points along a transect west of the drum cell. These five points ranged from a 2-foot distance from the drum cell wall to approximately 300 meters from the drum cell wall at Rock Springs Road, the closest accessible public location.

Baseline measurements were taken in 1987 and 1988 before the drums were stored in the cell. Two types of measurements were taken: instantaneous, using a high pressure ion chamber (HPIC), and cumulative, using thermoluminescent dosimeters (TLDs).

TLD measurements provide a much more accurate estimation of changes in the radiation field over extended periods of time than instantaneous measurements because they integrate the radiation exposure over an entire calendar quarter. Two sets of quarterly TLD measurements were taken at the Rock Springs Road locations nearest the drum cell. These locations are identified as TLD 28 and TLD 31 (see Fig. 2-9) and their measurements are found in Table C - 4.1 in Appendix C - 4.

To assess any increase in the gamma radiation field contributed at Rock Springs Road by the 10,000-plus drums in the drum cell, the two sets of four quarterly measurements were summed and averaged. An average annual exposure rate of 84 mR/yr was obtained. Compared to the pre-drum cell background rate of 86 mR/year recorded during 1987-1988, net contribution from the drum cell activities during 1990 cannot be distinguished from recorded annual variations in natural levels.

Investigation of Biological Radiological Transport

In April 1990 a combination of warm weather and optimum timing resulted in an unusually large insect hatch from one of the on-site liquid waste treatment ponds. A routine radiological

survey of sweepings containing flying adults attracted to facility lighting revealed detectable contamination. An investigation of the source of the insects confirmed that a large number (estimated to be several million) of midges of the *Chironomus* family had hatched from feed Lagoon 2 in the low-level waste treatment system.

Subsequent collection of midges and investigation of the holding pond conditions revealed that a plant ion exchange process adjustment initiated several years earlier had resulted in a pH change to the feed water. The feed water stabilized at a lower pH in which the *Chironomus* insects could thrive but that was still high enough to discourage predator insects. The midges had absorbed radioactivity by living in the contaminated feed water and had retained a detectable amount when they hatched to flying adults.

Contamination of individual insects could not be detected by direct counting. By analyzing a number of midges together, however, an estimate of the radioactivity contained in each insect was possible. About 2.6 picocuries of cesium-137 was calculated for each midge, with a maximum release of 30 μCi estimated for the overall hatch. Radiochemical analyses of the midges for strontium-90 and actinides showed the strontium-90 isotope to be fifty times less than the cesium-137 and the actinides to be three hundred times less than the cesium-137.

In comparison, one routine release from the treatment system at well below the Department of Energy DCG limits would contain four hundred times more radioactive material than the maximum estimated material transported out of the lagoon by this insect hatch. It was determined that the maximum potential radioactivity levels transported would not have exceeded reporting levels or action limits and that the release was of no consequence to the public health or environment.

The pH in Lagoon 2 was adjusted upward to discourage or prevent further insect hatches. As a long-term solution, several insecticide treatments and pond-covering methods were proposed. The effectiveness of the pH control,

along with the practicality of other controls, will be evaluated during the 1991 calendar year.

Storage Facilities Air Sampling

Special air sampling at the West Valley Demonstration Project during the summer and fall of 1989 began a preliminary investigation to demonstrate compliance with DOE Draft Order 5400.6. Several enclosed radioactive waste storage areas on-site are not at present directly monitored with air sampling equipment by the Environmental Laboratory. They are, however, routinely monitored by the Radiation and Safety Department (R&S) for surface contamination and exposure rates. The study was designed to confirm that this monitoring by R&S is an appropriate practice and within established guidelines for the site.

The sampling method used in the study was similar to that used for routine sampler locations on- and off-site. The areas sampled were the lag storage building; the lag storage building, annex 1 (LSA-1); the lag storage building, annex 2 (LSA-2); the drum cell; the chemical process cell hardstand; the NRC-licensed disposal area (NDA) tent; and the NRC-licensed disposal area hazardous/mixed waste storage building (see Table 2-1).

All seven sites are diffuse sources and do not presently require NESHAPS applications. (A diffuse source is defined as an area source or a collection of point sources that discharge into the atmosphere.) In general, diffuse sources can be difficult to categorize. However, the locations in question here are all of similar geometry and structure.

The site also currently operates seven separate fixed point sources. (A point source is defined in DOE Draft Order 5400.6 as "a single defined point [origin] of an airborne release such as a vent or stack.") At present, all point sources on-site are continuously sampled by the Environmental Laboratory or R&S groups (see section 2.1.1 above).

Sampling and analysis methodologies followed current routine procedures. It was calculated that the sample volume needed to attain op-

trium detection levels would be approximately 500,000 liters. Two locations, however, were not supplied with electricity and so the volumes at those points were reduced to a four-day, thirty-two hour sample of 250,000 liters to accommodate the use of a portable electric generator.

The sampling train consisted of a 47-milimeter open-faced filter head, 3/8" copper tubing (where applicable after the filter head), a glass fiber filter (Gelman type A/E), a Rockwell calibrated dry gas meter and a 3/4 horsepower carbon vane vacuum pump. Filtered exhaust from the pump was passed through a desiccant column apparatus designed to absorb water vapor for tritium analysis. Flow through the desiccant column was 500 cc/min.

At each location the sampling equipment was placed in a spot judged to represent the area of highest possible contamination.

All seven glass fiber filter samples were counted for both gross alpha and beta and for gamma contamination. Water samples from the desiccant columns were analyzed for

tritium. All samples were also given ample time to allow for the decay of naturally occurring radon daughters.

Background samples for alpha, beta, and gamma analysis were collected from the Dunkirk, New York sampling station, which collects background samples for the Environmental Laboratory's air monitoring program. The tritium background sampling station is in Great Valley, New York.

The background alpha/beta values for the week of May 29, 1990 are for a volume of 227,000 liters and the background tritium values are for 2,520 liters of air. The cesium-137 background value is also for the same location but for the fourth quarter composite from 1989 and has a volume of approximately 4 million liters of air. The effect of these high air volumes is that the minimum detection limit is lowered because the final analytical result must be divided by the total volume.

Several values reported for on-site diffuse sources are above the typical background values. However, almost all are still below the

Table 2-1
Storage Facilities Air Sampling Counting Results ($\mu\text{Ci}/\text{mL}$ air)

Location:	<u>Alpha</u>	<u>Beta</u>
LAG	3.38±0.88 E-15	7.51±1.29 E-15
LSA-1	5.92±1.78 E-15	9.73±2.49 E-15
LSA-2	1.17±0.31 E-14	2.18±0.44 E-14
Drum Cell	4.18±1.35 E-15	8.83±2.05 E-15
CPC Hardstand	2.09±0.45 E-14	3.03±0.54 E-14
NDA Tent	4.79±0.14 E-15	1.59±0.23 E-14
NDA Building	6.32±1.56 E-15	1.47±0.23 E-15
Background	2.53±2.53 E-16	7.72±2.50 E-15
	<u>Cs-137</u>	<u>H-3</u>
LAG	< 1.4 E-14	5.66±0.57 E-12
LSA-1	< 1.4 E-14	4.49±0.45 E-12
LSA-2	< 1.4 E-14	5.97±0.60 E-12
Drum Cell	< 1.4 E-14	6.83±0.68 E-14
CPC Hardstand	< 1.4 E-14	2.19±0.22 E-12
NDA Tent	< 1.4 E-14	6.03±0.60 E-12
NDA Building	< 1.4 E-14	5.09±0.51 E-12
Background	< 5.23E-16	1.62±0.16 E-12

most conservative derived concentration guides (DCGs) for radionuclides in air (see Appendix B). The DCG for gross alpha used at the WVDP site is $2E-14$ mCi/mL (as for americium-241), the DCG for gross beta is $3E-12$ mCi/mL (as for radium-228) and the DCG for tritium is $1E-7$ mCi/mL. Because of the difficulty of sampling with a portable generator the CPC location had the lowest volume of air and the optimum detection levels were not achieved.

Solvent Contamination Monitoring

In November 1983, organic contamination was encountered in a USGS series-82 groundwater monitoring well near the NRC-licensed disposal area (NDA). Waste organic solvent composed of n-dodecene mixed with tributyl phosphate had been buried in tanks when the NFS, Inc. reprocessing facility had been operating. Wells were drilled from 1984 to 1986 to monitor and recover the solvent from the disposal area. The apparent movement of solvent away from the buried location in 1988 initiated more extensive monitoring and characterization of the area.

Changes in the organic solvent levels that were observed in some wells monitored in November 1989 by the WVNS waste management group renewed concerns of migration.

In December 1989 nonroutine sampling of wells 85-I-9, 89-5-N and 89-14-E was carried out to determine the chemical and radiological makeup of the solvent-contaminated groundwater. Well 85-I-9 is a 6-inch diameter PVC-cased well, while the remaining two are steel-cased 2-inch wells. These wells were selected because they had exhibited increases in organic levels.

Samples collected from the wells were submitted for a variety of analyses including volatile and semivolatile organics, pesticides, PCBs, and tributyl phosphate. A sufficient sample volume collected from well 85-I-9 allowed for additional testing. Metals, biological and chemical oxygen demand, water quality, and selected radiological and nonradiological parameters were included in the analyses.

Analytical results of an independent laboratory were presented in the 1989 site environmental report. Their findings yielded results below analytical detection limits with only a few exceptions (see the WVDP Site Environmental Report for Calendar Year 1989, Appendix E, Table E-15). Additional positive results for a variety of unknown compounds, mainly saturated hydrocarbons, were also reported. These findings support the belief that the detected compounds originated from the organic solvent used during reprocessing operations.

In response to the migrating organic solvent, an interceptor trench bordering the northeast and northwest boundaries of the NDA was installed in 1990. The trench, measuring approximately 250 meters (800 ft.) in length and having a maximum depth of 6.4 meters (21 feet), was constructed over an eighteen-month period. The purpose of the trench system is to intercept and collect any organic solvent leaching from the NDA. Once in the trench, the leachate will be routed to the liquid pretreatment system (LPS) where the solvent will be separated from the water and the water will be pretreated to remove iron and iodine-129. The remaining water will be directed to the LLWTF for further processing. This treatment system is scheduled to become operational in June 1991.

Liquid collected in the trench currently is being held in storage tanks and samples are removed for analyses before being pumped to Lagoon 2. At the present time no organics have been found in the trench collection system, indicating the solvent front has not yet reached the trench.

Monitoring of 85- and 89-series wells continued through 1990 by the WVNS waste management group. Wells are examined routinely for water and solvent level. Several new 90-series wells located along the northeast corner of the NDA were sampled in 1990 for selected parameters, including analysis for volatile organics. The results, as determined by a subcontracted laboratory, indicated no volatile organic contamination.

Monitoring of critical wells and liquid drainage to the trench will continue in an effort to track the migration patterns of the solvent leachate. The liquid pretreatment system (LPS) will be capable of handling an estimated flow rate of 11 liters (3 gal.) per minute through the trench. This would result in an annual treatment of approximately 6 million liters (1.6 million gal.) of contaminated water.

The interceptor trench and LPS will be operated within the limits of DOE orders and other applicable state and federal regulations. The system as a whole has been designed and is being operated in such a manner as to prevent the spread of organic solvent into the surface waters of New York State.

2.2 Nonradiological Monitoring

2.2.1 Air Monitoring

Nonradiological emission and plant effluents are controlled and permitted under New York State and U.S. Environmental Protection Agency regulations. The regulations that apply to the WVDP are listed in Table B-2 in Appendix B. The individual air permits held by the WVDP are identified and described in Table B - 3.

The nonradiological air permits are for minor sources of regulated pollutants that include particulates, nitric acid mist, oxides of nitrogen, and sulfur. However, because of their insignificant concentrations and small mass discharge, monitoring of these parameters currently is not required.

2.2.2 Surface Water Monitoring

Liquid discharges are regulated under the State Pollutant Discharge Elimination System (SPDES). The regulations that apply to the WVDP are listed in Appendix B. The WVDP holds a SPDES permit that identifies the outfalls where liquid effluents are released to Erdman Brook and that specifies the sampling and analytical requirements for each outfall (Fig. 2-11). This permit was modified in

1990 to include additional monitoring requirements at outfall WNSP001 (see Table B-3, Appendix B).

Three outfalls are identified in the permit: outfall 001, discharge from the low-level waste treatment facility (LLWTF); outfall 007, discharge from the sanitary and utility effluent mixing basin; and outfall 008, groundwater effluent from the perimeter of the low-level waste treatment facility storage lagoons. The conditions and requirements of the current SPDES permit are summarized in Table C-5.1 in Appendix C-5.

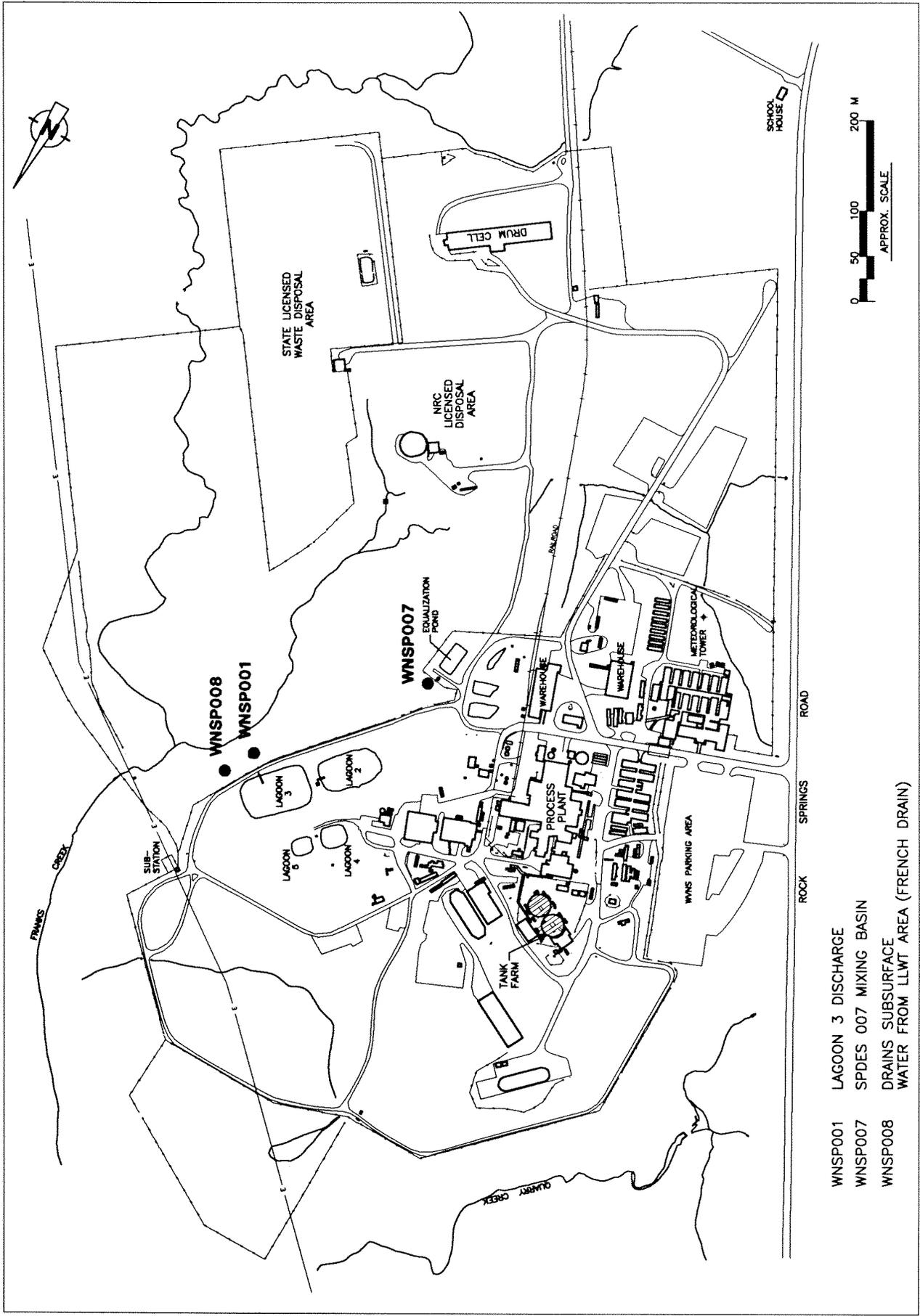
The most significant features of the SPDES permit are the requirements to report data as flow-weighted concentrations and to apply a net discharge limit for iron. The net limit allows for subtraction of incoming naturally present amounts of iron from the Project's effluent. The flow-weighted limits apply to the total discharge of Project effluents but allow maximum credit for dilute waste streams in determining compliance with effluent concentration limits specified in the permit.

The SPDES monitoring data for 1990 are graphically displayed in Figures C-5.2 through C-5.36 in Appendix C-5. The WVDP reported a total of nine noncompliance episodes in 1990 (Table C-5.2). These are described above in the Environmental Compliance Summary: Calendar Year 1990.

2.2.3 Special Monitoring

1,1,1 Trichloroethane Detection Investigation

Routine groundwater samples are collected from a seepage point (WNGSEEP) located on the west bank of Frank's Creek immediately east of the northeast corner of the site perimeter. It has been monitored for volatile organic compounds since October 1989. (See Figures 3-4 and 3-5 in Chapter 3.0, Groundwater Monitoring, for locations of on-site groundwater monitoring points.) During routine groundwater monitoring activities in 1990, measurable levels of 1,1,1-trichloroethane (1,1,1-TCA) were detected in samples collected from WNGSEEP (Fig 2-12).



- WNSP001 LAGOON 3 DISCHARGE
- WNSP007 SPDES 007 MIXING BASIN
- WNSP008 DRAINS SUBSURFACE WATER FROM LLWT AREA (FRENCH DRAIN)

Figure 2-11. SPDES Monitoring Points.

A measurable level of 1,1,1-TCA was detected for the first time when WNGSEEP was sampled on April 24, 1990. Before this, 1,1,1-TCA was not detected above the method detection limit in any of the groundwater monitoring wells. This first detection of 1,1,1-TCA was confirmed when volatile organic analysis results from June 6, 1990 and June 14, 1990 sampling showed measurable concentrations of this compound.

In response to the consistent detection of 1,1,1-TCA in WNGSEEP, a series of samples was taken on June 28, 1990 at three locations: Frank's Creek upstream of WNGSEEP influence; Frank's Creek downstream of WNGSEEP influence; and downslope of WNGSEEP, approximately three feet above Frank's Creek. The results suggest that 1,1,1-TCA is not detectable in WNGSEEP water as it runs down the bank towards Frank's Creek or in Frank's Creek itself either upstream or downstream of WNGSEEP.

During another sampling on July 9, 1990, samples were collected in the immediate vicinity of WNGSEEP (SEP101) to characterize the potential effect of the PVC pipe, the mechanism from which WNGSEEP water flows, and to provide further insight into the loss of 1,1,1-TCA after the water emerges from the ground and begins to run downhill towards Frank's Creek (SEP102). The results suggest that the PVC pipe does not have an effect on 1,1,1-TCA concentrations and that 1,1,1-TCA is not detectable in water collected very near to the outlet of WNGSEEP. (See Fig.2-12 for a graphical

representation of 1,1,1-TCA in WNGSEEP during 1990).

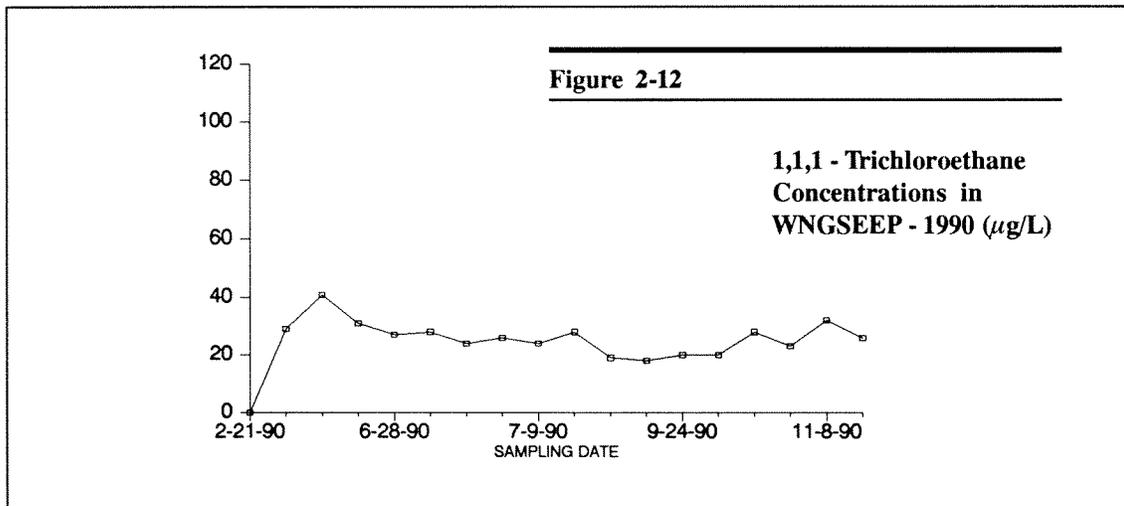
An HNU organic vapor analyzer was also used to investigate the power substation area, which is believed to be upgradient of WNGSEEP. The HNU did not detect any organic vapors originating from the substation area.

Five soil gas measurements were also made by collecting soil gas samples with a gas-tight syringe and analyzing the collected gas with GC/MS. Three samples were collected in the vicinity of the construction and demolition debris landfill, and two samples were collected near the location of WNGSEEP. The sample in the immediate vicinity of WNGSEEP was the only one to show detectable levels of 1,1,1-TCA.

Estimated calculations have shown that any quantities of 1,1,1-TCA released from the site are well below the reportable quantities listed in federal regulations (40 CFR, part 302, July 1, 1989 edition). No source of the 1,1,1-TCA has yet been identified.

1,1-Dichloroethane

During October 1989 samples from groundwater monitoring wells were collected and analyzed for volatile organic compounds. The analysis indicated positive detections of 1,1-dichloroethane in three groundwater monitoring wells at levels greater than the



analytical detection limit of 5 $\mu\text{g/L}$. These wells, WNW86-09, WNW86-12, and WNW-1 exhibited concentrations ranging from 6.5 $\mu\text{g/L}$ to 18.5 $\mu\text{g/L}$. This trend continued through 1990 in WNW86-09 and WNW86-12, with concentrations ranging between 6.5 $\mu\text{g/L}$ and 14 $\mu\text{g/L}$. The remaining groundwater wells that were monitored in 1990 lacked positive detections of 1,1-dichloroethane above method detection limits, suggesting there is no widespread contamination of this compound throughout the site. The source of the 1,1-dichloroethane has not been identified.



**Sampling with a Dedicated Bladder Pump
Installed in an On-site Groundwater Monitoring Well**

3.0 Groundwater Monitoring

3.1 Geology of the West Valley Site

3.1.1 Geologic History

The West Valley Demonstration Project is located on the dissected and glaciated Allegheny Plateau at the northern border of Cattaraugus County in southwestern New York. The area is drained by Cattaraugus Creek, which is part of the Great Lakes – St. Lawrence watershed (Tesmer 1975). Geologic conditions encountered at the site are the result of recent events in the earth's history, including repeated glaciation during the Pleistocene epoch 1.6 million to ten thousand years ago.

The WVDP site rests immediately on a thick sequence of glacial deposits that ranges up to 150 meters (5 ft. to 500 ft.) in thickness. These glacial deposits are underlain by an ancient bedrock valley eroded into the upper Devonian shales and siltstones of the Canadaway and Conneaut Groups that dip southward at about 5 m/km (Rickard 1975). Total relief in the area is approximately 396 meters (1,300 ft.), with summits reaching 732 meters (2,400 ft.) above sea level.

Oscillations of the Laurentide ice sheet during the ice ages include four major stages of ice advance and retreat. The last of these and the one of greatest concern here was the Wisconsinan glaciation (Broughton et al. 1966).

The most widespread glacial unit in the site area is the Kent till, deposited between 15,500 and 24,000 years ago toward the end of the Wisconsinan glaciation. At that time the ancestral Buttermilk Creek Valley was covered with ice. As the glacier receded, debris trapped in the ice was left behind in the vicinity of West Valley. Meltwater, confined to the valley by the debris dam at West Valley and the ice

front, formed a glacial lake that persisted until the glacier receded far enough northward to uncover older drainageways. As the ice continued to melt, more material washed out and was deposited to form the lacustrine and kame delta deposits that presently overlie the Kent till. Continued recession of the glacier ultimately led to drainage of the proglacial lake and exposure of its sediments to erosion (LaFleur 1979).

About 15,000 years ago the ice began its last advance (Albanese et al. 1984). Material from this advance covered the kame delta and lacustrine deposits with as much as 40 meters (130 ft.) of glacial till. This unit, the Lavery till, is the uppermost unit throughout much of the site, with a thickness of about 24 meters (80 ft.) at the waste burial areas. The retreat of the Lavery ice left behind another proglacial lake that ultimately drained, allowing modern Buttermilk Creek to flow northward to Cattaraugus Creek. The modern Buttermilk Creek has cut the modern valley since the final retreat of the Wisconsinan glacier. Post-Lavery outwash and alluvial fans, including the fan that underlies the northern part of the WVDP, were deposited on the Lavery till between 15,000 and 14,200 years ago (LaFleur 1979).

3.1.2 Hydrogeology

The site can be divided into two regions: the north plateau, on which the plant and its associated facilities reside, and the south plateau, which contains the NRC-licensed disposal area (NDA) and the state-licensed disposal area (SDA) that were previously used to dispose of waste (Figs. 3-1 and 3-2).

The uppermost geologic unit on the south plateau is the Lavery till, a very compact, gray

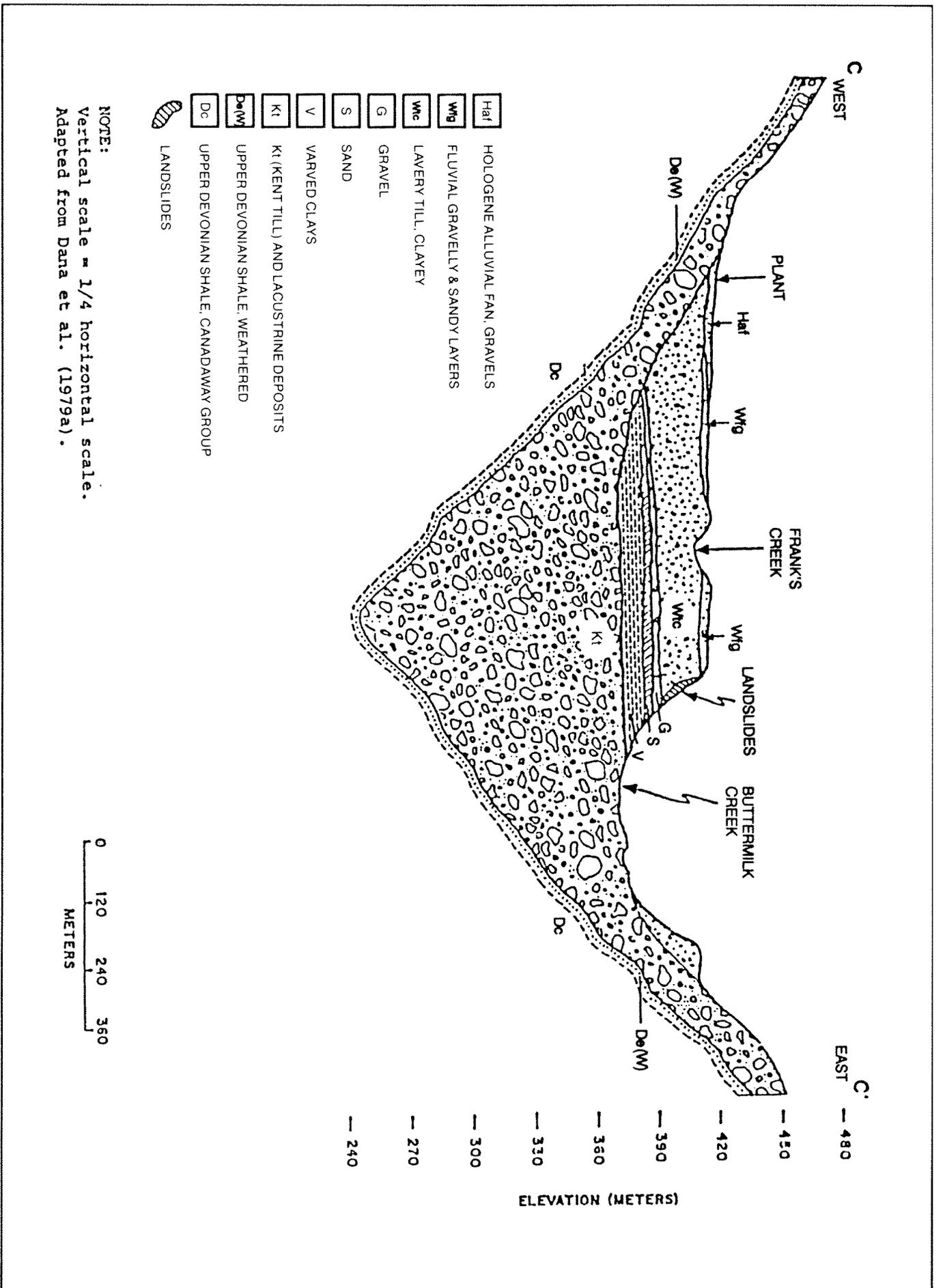


Figure 3-1. Geological Cross Section Through the North Plateau.

silty clay with scattered pods of silt to fine sand. Below this is a sequence of more permeable lacustrine silt and sand, which in turn overlies the less permeable Kent till.

North Plateau

The north plateau differs from the south plateau in that it is mantled by a sequence of alluvial sand and gravel up to 10 meters thick that is immediately underlain by the Lavery till.

The depth to the groundwater on the north plateau varies from 0 meters to 5 meters (0 ft. to 16 ft.), being deepest at the process building and intersecting the surface farther north towards the security fence. Most of the groundwater beneath the north plateau moves horizontally through the alluvial sand and gravel unit from an area southwest of the process building to the northeast, southeast, and east; a small percentage percolates downward into the underlying Lavery till (Yager 1987). Groundwater discharge from the north plateau occurs at seepage points along the banks of Frank's Creek, Erdman Brook, Quarry Creek, and at the wetlands near the northern perimeter of the security fence. The geometric mean of the hydraulic conductivity of the alluvial sand and gravel unit is 4.6×10^{-3} cm/sec (Bergeron et al. 1987). Recent on-site investigations (1989-1990) identified a sandy unit of limited areal extent and variable thickness within the Lavery till, primarily beneath the north plateau. This unit, called the till-sand, was not specifically identified in previous studies as a potential water-bearing/transmitting unit.

South Plateau

The water table beneath the south plateau occurs in the upper 4.5 meters (0 ft. to 15 ft.) of the Lavery till. Groundwater flow in this unit, for the most part, is vertical to the lacustrine unit. The upper, weathered portion of the Lavery till exhibits a horizontal flow, which enables groundwater to move laterally before moving downward or discharging to nearby land-surface depressions or stream channels. (Bergeron and Bugliosi 1988). Some laterally moving water eventually percolates downward into the underlying unweathered till. Values of

vertical and horizontal hydraulic conductivity obtained from laboratory analysis of undisturbed cores and from field analyses of piezometer recovery tests suggest that the till is virtually isotropic. The hydraulic conductivity of the fresh, unweathered till averages 2.92×10^{-8} cm/sec. Hydraulic conductivity values of the fractured unweathered till are five times greater than that of the fresh, unweathered till, and the hydraulic conductivity of the fractured weathered till is ten times greater than that of the fresh, unweathered till.

The lacustrine silt sequence at the WVDP acts as a semiconfined unit that is recharged primarily from the bedrock to the west. Water levels in piezometers completed in this unit indicate a northeastward lateral flow gradient of 0.023. Minor recharge also occurs from the overlying Lavery till, making this unit a possible conduit of Lavery discharge to Buttermilk Creek. The lacustrine unit is underlain by the relatively impermeable Kent till (LaFleur 1979).

3.2 Groundwater Monitoring Program Overview

In 1990 the groundwater monitoring network was expanded to include wells for monitoring an expanded group of solid waste management units (SWMUs), increasing the number of waste management unit monitoring points on-site from 17 to 106. The two monitoring networks, referred to as "the 1990 monitoring network" and "the expanded monitoring network" are described below.

» 1990 Monitoring Network

This network contains wells installed before 1990. During 1990 the wells were each sampled eight times for the parameters outlined in Table 3-1 under the 1990 monitoring network.

» Expanded Monitoring Network

This network includes wells installed during 1990 and selected existing wells. The wells monitor specific waste management units (Table 3-2) and will be monitored for the

TABLE 3-1

SCHEDULE OF GROUNDWATER SAMPLING AND ANALYSIS

	<u>1990 Monitoring Network</u>	<u>Expanded Monitoring Network</u>
Contamination Indicator Parameters	pH*	pH*
	Total Organic Carbon	Total Organic Carbon
	Gross Alpha	Gross Alpha
	Specific Gamma Emitters	Gamma Scan
	Conductivity*	Conductivity*
	Total Organic Halogens	Total Organic Halogens
	Gross Beta	Gross Beta
	Tritium	Tritium
	Volatile Organic Analysis	Volatile Organic Analysis
	Nitrate	
Groundwater Quality Parameters	Chloride	Chloride
	Iron	Iron
	Sodium	Sodium
	Manganese	Manganese
	Phenols	Phenols
	Sulfate	Sulfate
		Magnesium
		Nitrate
		Calcium
		Potassium
		Ammonia
		Bicarbonate/Carbonate
EPA Interim Primary Drinking Water Standards	Arsenic	Arsenic
	Barium	Barium
	Cadmium	Cadmium
	Chromium	Chromium
	Lead	Lead
	Mercury	Mercury
	Selenium	Selenium
	Silver	Silver
	Fluoride	Fluoride
		Endrin
		Methoxychlor
		2,4 D
		Radium
		Nitrate
		Lindane
		Toxaphene
		2,4,5-TP Silvex
	Turbidity*	

* Measured in field

TABLE 3 - 2

SUPER SOLID WASTE MANAGEMENT UNIT MONITORING NETWORK

Constituent SWMUs	Well Identification Number	Year Installed ¹	Well Position	Well Depth <i>Depth below-grade (feet)</i>
SSWMU No.1 - Low-Level Waste Treatment Facilities:				
● Lagoon 1	WNW-0103	90	U	21.00
● LLWTF Lagoons	WNW-0104	89	U	23.00
● LLWTF Building	WNW-0105	89	D	28.00
	WNW-0106	89	D	14.50
	WNW-0107	90	D	28.00
	WNW-0108	90	D	33.00
	WNW-0109	90	D	33.00
	WNW-0110	90	D	33.00
	WNW-0111	90	D	11.00
	WNW-0114	90	D	29.00
	WNW-0115	90	D	28.00
	WNW-0116	90	D	11.00
	WNW-86-03	86	D	25.42
	WNW-86-04	86	D	23.00
	WNW-86-05	86	D	13.00
	WNSP008		Groundwater French Drain Monitoring Point	
SSWMU No. 2 - Miscellaneous Small Units:				
	WNW-0201	89	U	20.00
● Sludge Ponds	WNW-0202	89	U	38.00
● Solvent Dike	WNW-0203	89	U	18.00
● Effluent Mixing Basin	WNW-0204	89	U	43.00
● Paper Incinerator	WNW-0205	90	D	11.00
	WNW-0206	90	D	37.80
	WNW-0207	90	D	11.00
	WNW-0208	90	D	23.00
	WNW-86-06	86	D	13.00
SSWMU No. 3 - Liquid Waste Treatment System:				
	WNW-0301	89	U	16.00
● Liquid Waste Treatment System	WNW-0302	89	U	28.00
	WNW-0305	89	D	31.00
	WNW-0306	89	D	81.00
	WNW-0307	89	D	16.00

Key:

¹ Wells installed in 1989 and 1990 are considered 90-series wells.

U = upgradient C = crossgradient D = downgradient B = background

TABLE 3 - 2 (continued)

SUPER SOLID WASTE MANAGEMENT UNIT MONITORING NETWORK

Constituent SWMUs	Well Identification Number	Year Installed ¹	Well Position	Well Depth <i>Depth below-grade (feet)</i>
SSWMU No. 4 - HLW Storage and Processing Area:				
● Vitrification Test Facility	WNW-0401	89	U	16.00
	WNW-0402	89	U	29.00
	WNW-0403	89	U	13.00
	WNW-0404	89	U	36.50
	WNW-0405	89	D	12.50
	WNW-0406	89	D	16.80
	WNW-0407	90	D	75.50
	WNW-0408	90	D	38.00
	WNW-0409	90	D	55.00
	WNW-0410	89	U	78.00
	WNW-0411	90	U	65.50
	WNW-86-07	86	D	18.75
	WNW-86-08	86	D	19.00
	WNW-86-09	86	D	25.00
SSWMU No. 5 - Maintenance Shop Leach Fields:				
● Maintenance Shop Leach Fields	WNW-0501	90	U	33.00
	WNW-0502	89	D	18.00
SSWMU No. 6 - Low-Level Waste Storage Area:				
● Hardstand ● Lag Storage ● Lag Storage Extension	WNW-0601	90	D	6.00
	WNW-0602	90	D	13.00
	WNW-0603	89	D	13.00
	WNW-0604	89	D	11.00
	WNW-0605	90	D	11.00
	WNW-86-04	86	D	23.00
	WNW-86-07	86	U	18.75
	WNW-86-08	86	U	19.00

Key:

¹ Wells installed in 1989 and 1990 are considered 90-series wells.

U = upgradient C = crossgradient D = downgradient B = background

TABLE 3 - 2 (continued)

SUPER SOLID WASTE MANAGEMENT UNIT MONITORING NETWORK

Constituent SWMUs	Well Identification Number	Year Installed ¹	Well Position	Well Depth <i>Depth below-grade (feet)</i>	
SSWMU No. 7 - CPC Waste Storage Area:					
● CPC Waste Storage Area	WNW-0701	89	U	28.00	
	WNW-0702	89	D	38.00	
	WNW-0703	89	D	21.00	
	WNW-0704	89	D	15.50	
	WNW-0705	90	D	21.00	
	WNW-0706	90	U	11.00	
	WNW-0707	90	U	11.00	
SSWMU No. 8 - Construction and Demolition Debris Landfill:					
● Construction and Demolition Debris Landfill	WNW-0801	89	U	17.50	
	WNW-0802	89	D	11.00	
	WNW-0803	89	D	18.00	
	WNW-0804	89	D	9.00	
	WNGSEEP	Groundwater Seepage Monitoring Points			
	WNDMPNE				
	WNW86-12	86	D	18.83	
	WNW-NB-1S	90	B	13.00	
(N. Plateau Background)					
SSWMU No. 9 - NRC-Licensed Disposal Area:					
● NRC-licensed Disposal Area	WNW-0901	90	U	136.0	
	WNW-0902	90	U	128.0	
	WNW-0903	90	D	133.0	
● Container Storage Area	WNW-0904	90	D	26.00	
	WNW-0905	90	D	23.00	
	WNW-0906	89	D	10.00	
	WNW-0907	89	D	16.00	
	WNW-0908	90	U	21.00	
	WNW-86-10	86	D	114.0	
	WNW-86-11	86	D	120.0	

Key:

¹ Wells installed in 1989 and 1990 are considered 90-series wells.

U = upgradient C = crossgradient D = downgradient B = background

TABLE 3 - 2 (concluded)

SUPER SOLID WASTE MANAGEMENT UNIT MONITORING NETWORK

Constituent SWMUs	Well Identification Number	Year Installed ¹	Well Position	Well Depth <i>Depth below-grade (feet)</i>
SSWMU No. 10 - IRTS Drum Cell:				
● IRTS Drum Cell	WNW-1001	90	U	116.0
	WNW-1002	90	D	113.0
	WNW-1003	90	D	138.0
	WNW-1004	90	D	108.0
	WNW-1005	90	U	19.00
	WNW-1006	90	D	20.00
	WNW-1007	90	U	23.00
	WNW-1008b	90	B	51.00
	WNW-1008c	90	B	18.00
SSWMU No. 11 - State-Licensed Disposal Area:				
● State-licensed Disposal Area (SDA)	WNW-1101a	90	U	16.00
	WNW-1101b	90	U	30.00
	WNW-1101c	90	U	110.0
	WNW-1102a	90	D	17.00
	WNW-1102b	90	D	31.00
	WNW-1103a	90	D	16.00
	WNW-1103b	90	D	26.00
	WNW-1103c	90	D	111.0
	WNW-1104a	90	D	19.00
	WNW-1104b	90	D	36.00
	WNW-1104c	90	D	114.0
	WNW-1105a	90	D	21.00
	WNW-1105b	90	D	36.00
	WNW-1106a	90	U	16.00
	WNW-1106b	90	U	31.00
	WNW-1107a	90	D	19.00
	WNW-1108a	90	U	16.00
	WNW-1109a	90	U	16.00
	WNW-1109b	90	U	31.00
	WNW-1110	90	D	20.00
WNW-1111	90	D	21.00	
Fuel Storage Area				
	R86-13A	89	C	8.00
	R86-13B	89	C	8.00
	R86-13C	90	D	6.50

Key:

¹ Wells installed in 1989 and 1990 are considered 90-series wells.

U = upgradient C = crossgradient D = downgradient B = background

parameters noted in Table 3-1. Sampling of these wells will be phased in during 1991. Selected sampling locations from the 1990 network were incorporated into the expanded monitoring network. Although the expanded groundwater monitoring program will not be fully implemented until 1991, monitoring of some of the new wells began in 1990.

Monitoring Wells

Four designations are often used to indicate a well's function within a groundwater monitoring program:

Upgradient well. A well installed hydraulically upgradient of the waste management unit under study that is capable of yielding groundwater samples that are representative of local conditions and that are not affected by the unit in question.

Downgradient well. A well installed hydraulically downgradient of the waste management unit that is capable of detecting the migration of contaminants from the unit under study.

Background well. A well installed hydraulically upgradient of all waste management units that is capable of yielding groundwater samples that are representative of natural conditions. In some cases, upgradient wells may be positioned downgradient of other facilities, which makes them unsuitable for use as true background wells. However, their usefulness in providing upgradient information about the unit under study is still maintained.

Crossgradient well. A well installed to the side of the major downgradient flow path.

Before 1990 the on-site groundwater monitoring network for monitoring waste management units included fifteen wells, a groundwater seep, and the outlet of a french drain. These points monitored three solid waste management units: the low-level waste treatment facility (LLWTF), the high-level waste storage and processing area (HLW), and the NRC-licensed disposal area (NDA). Each of these three waste management units was monitored using one upgradient well and several downgradient wells. The downgradient

wells were positioned to maximize the probability of intercepting contaminants.

Sampling results for downgradient wells are evaluated by comparing upgradient to downgradient concentrations. Increases in amounts of monitored contaminants and increases or decreases in pH may indicate that the groundwater has been affected.

Expanded Monitoring Network

Wells are labeled as a series, beginning with the year in which they were installed. The 80- and 82-series wells, which were installed in 1980 and 1982, were sampled throughout the year. They will be phased out in 1991 as new wells are brought online to replace them (Fig.3-3).

Expansion of the groundwater program was necessary in order to adequately monitor and characterize the site's groundwater conditions. The WVDP Groundwater Protection Management Plan (WVNS 1990) established the overall framework for managing the site's groundwater resources.

Individually identified waste management units were grouped together into super solid waste management units or super SWMUs (SSWMUs). Each super solid waste management unit (see Fig. E-28 in Appendix E) has its own set of wells specified by individual identification numbers. (See Table 3-2 and section 3.2.4 below.) As in the earlier program, each unit has a set of upgradient and downgradient wells (Fig. 3-4).

When the new program is fully implemented, the analyses shown in Table 3-1 will be performed. The new parameters differ from the former in several respects. The samples collected in the new program are divided into three categories: contamination indicator parameters, for which samples are collected eight times a year; groundwater quality parameters, for which samples are collected two times a year; and EPA interim primary drinking water parameters, for which samples are collected four times per year. Samples for comparison with the EPA primary drinking water standards will be collected for one year only for a total of four samples from each well.

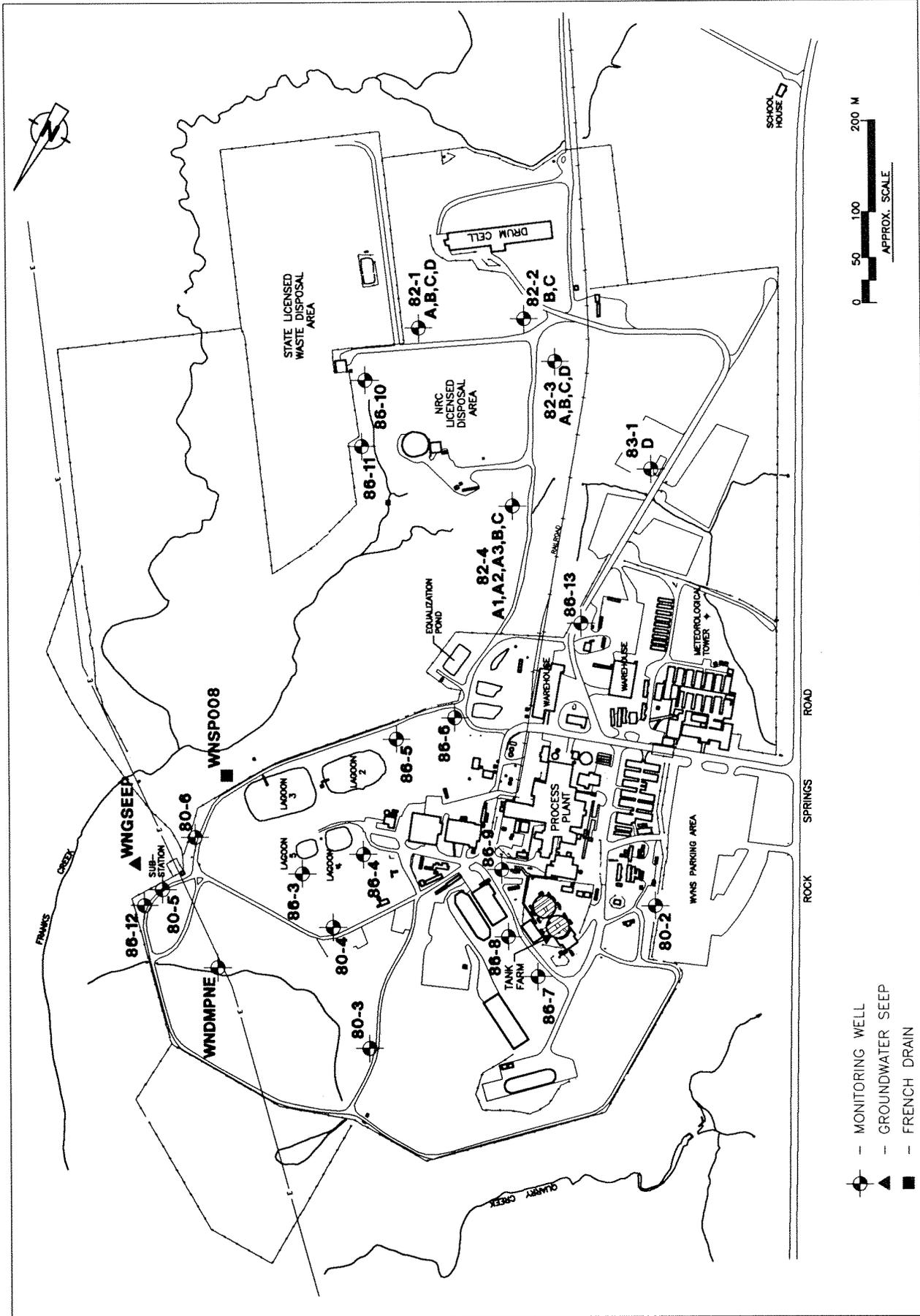


Figure 3-3. Groundwater Monitoring Points 1986–1990.



Figure 3-4. Expanded Monitoring Program Sampling Locations (SSWMUS).

Monitoring the contamination indicator parameters helps to indicate a release from a solid waste management unit to the groundwater. Depending on the results, follow-up investigations to determine the nature and extent of the release may be required. The groundwater quality parameters selected provide information essential for migration modeling and for evaluating the indicator parameter results and the potential effect of a release. Monitoring of the EPA interim primary drinking water standards on groundwater establishes a baseline for water quality. The results of all of the samples analyzed will identify their relationship to regulatory requirements and will provide information for eventual closure of the super solid waste management units.

3.2.1 Initial Development of the 90-Series Wells

New wells must be developed to condition them for sample collection. The well development process is designed to remove suspended sand, silt, and clay materials from the well before it is used to collect proper groundwater samples. This preliminary process, which removes fines from the filter pack and formation, helps ensure that only representative groundwater samples are collected for analysis. All of the 90-series wells were developed during 1990.

3.2.2 Sampling Methodology

Several different methods were used to collect groundwater samples from both waste management unit wells and other wells on-site. The method chosen depends on well construction, water depth, the water-yielding characteristics of the well, and the type of analysis to be performed.

» Peristaltic pumps

Powered by a portable generator, a peristaltic pump was used to collect samples from shallow wells. A peristaltic pump uses suction and thus tends to drive volatile chemical compounds out of solution as well as agitate the water. Samples for volatile analysis were not

collected using this method. Instead, a teflon bailer was used for volatile sample collection.

» Well bailers

The bailer is the simplest system used for groundwater sample collection. A bottom-filling bailer, which is a tube with a check valve in the bottom, is lowered into the well until it reaches the desired location in the water column. The bailer is then retrieved along with the water sample. If the bailer is lowered slowly through the water column there is little chance of agitating the water. The bailer, string, and bottom-emptying device used to drain the bailer are all dedicated to the well by keeping them inside that particular well when not in use.

Teflon bailers, dedicated to individual wells, are a major part of the new groundwater monitoring program.

» Inertial pumps

An inertial pumping system has been used for several years at the WVDP as an inexpensive, dedicated sampling system for waste management unit wells. Inertial pumps use a dedicated piece of tubing with a check valve on the bottom. The tubing extends from the bottom of the well to the surface. An up-and-down motion of the tube causes water to move up and out of the well. This system, although effective, is being replaced by bladder pumps, which fully meet all regulatory requirements for groundwater monitoring.

» Bladder pumps

The bladder pump uses compressed air to gently squeeze a teflon bladder located near the bottom of the well, thus expelling the water out the sample line. The pressure is then released allowing new groundwater to flow into the bladder. A series of check valves ensures that water flows only in one direction. The drive air is always kept separate from the sample and is expelled to the surface by a separate line. For wells with low standing volume, where bladder pumps are inefficient, a dedicated teflon bailer is used for sample

collection. Bladder pumps provide an effective system for groundwater sample collection. The system reduces mixing and agitation of the water within the well compared to some other sampling methods. The bladder pump is dedicated to each individual well, thus reducing the likelihood of sample contamination from the introduction of external materials into the well. The compressor and air control box are shared between the different wells but attach externally to the pump and do not come in contact with the inside of the well or the sample. The bladder system is also a low maintenance system with the only moving part being a replaceable teflon bladder. The expanded monitoring network relies upon dedicated bladder pumps and teflon bailers for sample collection. Both of these methods meet all regulatory requirements pertaining to groundwater sample collection.

Sample Collection

The groundwater monitoring year is divided into two semiannual periods. Four samples were taken from each well in the 1990 monitoring network during each semiannual period and tested for the parameters listed in Table 3-1. Before removing a sample from the well the water level is measured by using an electronic sounder. The water level measurement, well diameter, and the total depth are used to determine the standing water volume of the well.

To ensure that only representative groundwater is sampled, three well volumes are removed (purged) from the well before actual samples are collected. If three well casing volumes cannot be removed due to limited recharge, purging the well to dryness achieves the same result. Conductivity and pH are measured before and after sampling to help determine if the quality of the groundwater changed while samples were being collected.

After samples are collected, they are placed in a cooler with ice and returned to the Project's Environmental Laboratory. The samples are then either packaged for overnight delivery to an off-site contract laboratory or put into controlled storage to await on-site testing.

3.2.3 Monitoring Parameters

The groundwater parameters monitored in 1990 are shown in Table 3-1. Each of the seventeen monitoring points in the 1990 monitoring network were tested for gross alpha, gross beta, tritium, volatile organic compounds, total organic carbon, total phenols, total organic halogens, and total and soluble metals. Samples were collected for each parameter during sampling of the individual wells.

Monitoring parameters for the expanded monitoring network are also shown in Table 3-1. No routine sampling of the 90-series wells took place in 1990. But selected 90-series wells were sampled for alpha, beta, tritium, pH, and conductivity.

3.2.4 Expanded Monitoring Program: Solid Waste Management Units

The following descriptions of waste management units provide basic information about the super solid waste management units (SSWMUs) as detailed in the site's Sampling and Analysis Plan (SAP): Groundwater Monitoring Network (WVNS 1990). Monitoring wells were installed and well development was completed for all super solid waste management units (SSWMUs) during 1990. Full implementation of the expanded monitoring network will take place in 1991.

■ Low-level Waste Treatment Facility (SSWMU #1)

The low-level waste treatment facility (LLWTF) is comprised of four active lagoons – Lagoons 2, 3, 4, 5 – and Lagoon 1, an inactive lagoon that has been filled in and covered.

Lagoons 1, 4, and 5 were constructed in the surficial sand and gravel strata and Lagoons 2 and 3 penetrate into the Lavery till beneath the surficial sand and gravel. Lagoons 4 and 5 have membrane liners. A french drain (sampling point WN5P008) had been installed on the north and west sides of Lagoons 2 and 3 by the original operator of the reprocessing plant, NFS, in order to intercept and reduce groundwater seepage into Lagoons 2 and 3. The drain consists of a 15-cm diameter per-

forated pipe buried approximately 3 meters belowgrade. The drain extends almost to the top of the Lavery till and discharges to Erdman Brook, east of Lagoon 3.

SSWMU#1 was monitored by six existing wells, a ground seep, and monitoring point WNSP008 during 1990.

Under the expanded monitoring network the seep, WNSP008, and the 86-series wells were combined with the twelve new 90-series wells for a more comprehensive monitoring program. This new monitoring system was sampled for selected contamination indicator parameters during December 1990.

■ **Miscellaneous Small Units
(SSWMU #2)**

SSWMU#2 consists of four small facilities east of the southern end of the former reprocessing plant. They were grouped together as a super solid waste management unit because of their closeness to each other and because of the similarity of subsurface conditions beneath the units.

The individual facilities in SSWMU#2 are:

- ☒ The sludge pond, which contains demineralized backwash sludges from the process plant water treatment system. The sludge pond consists of two shallow, excavated beds in the surficial sand unit.
- ☒ The solvent dike, which was used to catch and temporarily retain runoff from the reprocessing plant's solvent storage terrace. The solvent storage dike is not lined.
- ☒ The effluent mixing basin, which mixes non-radioactive waste streams before discharge.
- ☒ The paper incinerator, which was used to dispose of cartons received in the warehouse and general trash generated in nonradioactive areas of the plant.

Monitoring of SSWMU#2 will focus on the surficial sand and gravel layer and the till-sand unit.

The upgradient and downgradient wells used to monitor SSWMU#2 are shown in Table 3-2. Well WNW86-6 will be used to sample downgradient conditions in the surficial sands.

■ **Liquid Waste Treatment System
(SSWMU#3)**

The liquid waste treatment system (LWTS) contains decontaminated liquid effluent from the supernatant treatment system (SSWMU #4). The liquid effluent from the LWTS is processed by the cement solidification system, producing a solid, low-level radioactive waste form suitable for disposal.

The wells used to monitor SSWMU#3 are shown in Table 3-2. Since monitoring of the two upper sand units (the surficial sand and gravel and till-sand) will provide evidence of a release, the lacustrine-kame delta deposits will not be monitored.

■ **High-level Waste Storage and Processing Area (SSWMU #4)**

The high-level waste storage (HLWS) and processing area includes the high-level radioactive waste tanks, the supernatant treatment system, and the vitrification facility. The high-level waste is stored in underground steel tanks inside reinforced concrete vaults. The vaults extend 40 feet below the surface into the Lavery till. It is this high-level waste that will be processed into a stable, glass waste form.

The 1990 monitoring network used a series of four monitoring wells: One upgradient well, WNW80-02, and three downgradient wells, WNW86-07, WNW86-08, and WNW86-09. Two additional sampling locations (WNW86-12 and WNDMPNE) were monitored with this unit to provide comparisons with a representative upgradient well. These additional locations monitor the former nonradioactive construction and demolition debris landfill (CDDL), which was closed in 1986. The CDDL is now classified as a separate SSWMU in the new program.

The expanded monitoring network will phase out previously existing well WNW80-02 and incorporate eleven new wells for a total of fourteen monitoring locations (see Table 3-2).

■ **Maintenance Shop Sanitary Leach Field (SSWMU #5)**

Groundwater monitoring will focus on a former leach field once used by the plant's maintenance shop to process sewage that the shop generated.

Two wells — one upgradient well (WNW0501) and one downgradient (WNW0502) — were added to this unit. As the upgradient well is downgradient of many other super solid waste management units, the background conditions will be monitored by wells WNW0301 and WNW0401.

■ **Low-level Waste Storage Area (SSWMU #6)**

The low-level waste storage area (LLWS) includes metal and fabric structures housing low-level radioactive wastes being stored for future disposal. All wastes are contained in steel cases. Currently the area contains one metal and four fabric storage structures. Additional downgradient wells will be used from adjacent SSWMUs. The area also includes the site of the old hardstand, which was used by NFS to temporarily store radioactive materials. The hardstand and the soils around it are still slightly radioactively contaminated.

■ **Chemical Process Cell Waste Storage Area (SSWMU #7)**

The chemical process cell (CPC) waste storage area is a fabric-covered structure placed on a compacted gravel floor. The CPC waste storage area contains packaged pipes, vessels, and debris from the decontamination and cleanup of the chemical process cell in the former reprocessing plant that are being stored until they can be conditioned in the planned noncontact size reduction facility for eventual disposal.

Seven new 90-series wells will be used for this groundwater monitoring network. Samples were collected from these wells for selected contamination indicator parameters during 1990.

■ **Construction and Demolition Debris Landfill (SSWMU #8)**

This disposal area was used by both NFS and the WVDP to dispose of nonhazardous and nonradioactive materials. There is no record of disposal of hazardous materials in this facility; however, there is also no evidence of waste acceptance procedures that would exclude them. The unit was closed in 1986 by a covering of a compacted clay till.

The lacustrine-kame delta is at least 100 feet below the surface. Monitoring of this SSWMU will focus on surficial deposits.

Four new 90-series wells will be used along with wells WNW86-03 and WNW86-12 to monitor SSWMU#8. The new 90-series wells were sampled for selected contamination indicator parameters during 1990.

■ **NRC-licensed Disposal Area (SSWMU #9)**

The NRC-licensed disposal area (NDA) contains radioactive wastes generated by NFS and the WVDP, including leached fuel assembly hulls and ends, sludges, spent solvents, discarded vessels and piping and other miscellaneous items. Groundwater monitoring of the NDA will use eight of the new 90-series wells and two previously existing 86-series wells (WNW86-10 and WNW86-11). Background information will be provided by wells WNW1008b and WNW1008c. Upgradient conditions will be monitored by three new 90-series wells. Locations of the wells are shown on Figure 3-4 and detailed in Table 3-2.

■ **Integrated Radioactive Waste Treatment System Drum Cell (SSWMU #10)**

The integrated radioactive waste treatment system (IRTS) drum cell contains stored cement-stabilized low-level radioactive waste produced in the cement solidification system of the liquid waste treatment system (SSWMU#3). In the future, cement-stabilized sludge-wash water and cleaning water from the noncontact size reduction facility will be stored here. This waste is currently classified as nonhazardous. The new 90-series monitoring wells will be used to surveil the groundwater in this area.

■ State-Licensed Disposal Area (SSWMU #11)

In 1990 the New York State Department of Environmental Conservation (NYSDEC) requested that the state-licensed disposal area be monitored. Twenty-one groundwater wells have been installed to monitor both the weathered and unweathered till and the lacustrine deposits beneath the SDA.

The SDA was operated by Nuclear Fuel Services, Inc. as a commercial low-level disposal facility. In addition to wastes from a wide variety of utility, industrial, and institutional customers, the SDA received a large volume of wastes from the NFS reprocessing operations. Between 1963 and 1975, 2.35 million cubic feet of low-level radioactive waste was disposed of in the SDA trenches.

The groundwater monitoring program for 1990 included sampling the twenty-one wells for gross alpha, gross beta, tritium, and gamma emitters. The results are found in Table E-16 in Appendix E. The full groundwater monitoring program for the SDA is planned to begin in mid-1991.

3.2.5 On-site Supporting Well Monitoring

In addition to specific waste management unit monitoring wells, other wells on-site have been monitored over the course of time, primarily for radiological parameters. Many of these wells were installed for purposes other than groundwater sample collection and will be decommissioned or taken out of the groundwater monitoring network as wells meeting RCRA regulations are gradually incorporated into the monitoring program.

These supporting wells (80- and 82-series) were sampled on a semiannual basis.

They comprise an on-site well monitoring network used principally to update historical data and to obtain water level measurements. During 1990 they were sampled for gross radiological constituents, tritium, isotopic gamma emitters, pH, and conductivity.

Well WNW86-13 also is included in the supporting well network. This well monitors the below-ground gasoline and diesel fuel storage area. Samples were collected from this location for selected volatile organic compounds — benzenes, toluene, and xylenes. The results of the analyses, in addition to fuel accounting coordinated by site warehouse personnel, are used to assess the integrity of the fuel tanks. Annual petro-tite testing began on these tanks during 1991 as an additional check of tank integrity. Samples to be analyzed for water quality parameters and radioactivity are also collected at this well.

3.2.6 Off-Site Groundwater Monitoring

Off-site wells, sampled for radiological parameters, pH, and conductivity, were also monitored as part of the groundwater sampling program. These wells are used by site neighbors as sources of drinking water (Fig. 3-5).

3.3 Groundwater Monitoring Results

The groundwater monitoring program at the West Valley Demonstration Project has undergone a substantial evolution, as described above. Some of the important results obtained during monitoring completed in 1990 are described below. The results rely on all aspects of the program, including proper well placement, the collection of representative groundwater samples, appropriate sample analyses, thorough data validation and quality control, data management, and data analysis or synthesis.

3.3.1 Interpretation of Groundwater Monitoring Data

Several different methods are used to help interpret the results obtained from the groundwater monitoring program.

- Presentation of Results in Tables

One of the first methods used to help interpret data is simply to format the results into tables.

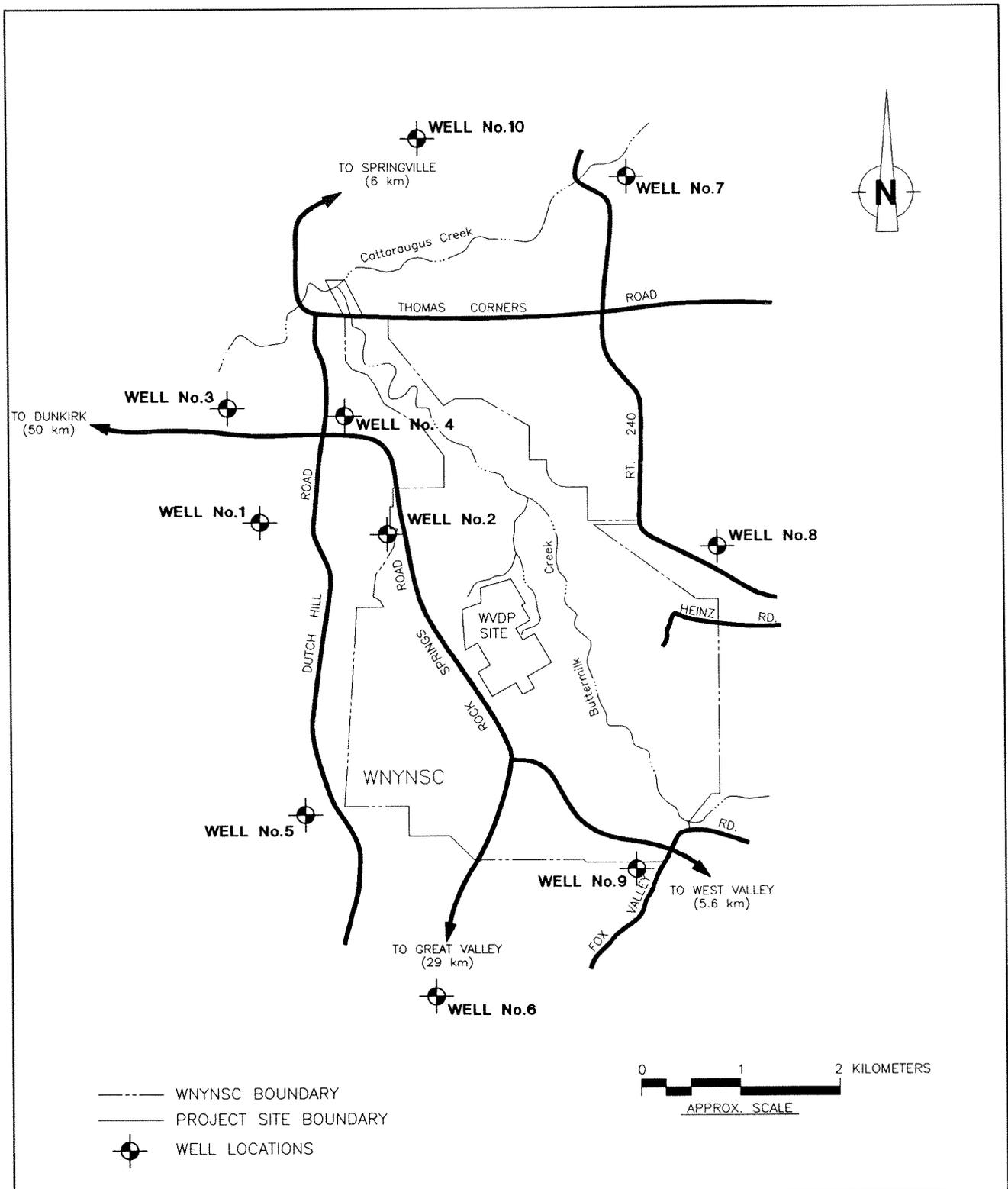


Figure 3-5. Off-Site Groundwater Monitoring Points.

Once results are in tables the data may be compared both within a single sample location and between various locations.

Appendix E provides appropriately formatted tables for the results obtained from the groundwater monitoring program carried out at the West Valley Demonstration Project during 1990. Results for the groundwater monitoring program completed during 1990 (the 1990 monitoring network) are shown in Appendix E, Tables E-3 through E-14. Results for the recently installed 90-series wells for super solid waste management units #1, #7, and #8 are shown in Appendix E, Table E-15. Note that in Tables E-3 through E-15 the hydraulic position of each well within the waste management unit is indicated. These "UP" or "DOWN" terms indicate whether a well is positioned upgradient or downgradient within the monitored waste management unit. Thus, these tables allow for comparison of data between wells within a given waste management unit on a well-to-well basis and an upgradient/downgradient basis. The New York State groundwater quality standards and selected Department of Energy concentration guides (DCGs) are also included in the table headings of Tables E-3 through E-14 for comparison to the groundwater monitoring results.

- Presentation of Results in Graphs

A second way in which selected results were prepared is through the use of trend graphs. Most of the 80- and 86-series wells in the waste management unit monitoring program have been sampled since 1986. Preparation of five-year trend graphs showing how selected key parameters have changed over time gives another perspective for looking at the data. Trend graphs, shown in Figures 3-6 through 3-17 at the end of this chapter, were prepared for pH, conductivity, gross beta, and tritium activity data for wells within a given waste management unit. These specific parameters and results were selected because these parameters tend to be sensitive to changes in chemical and/or radiological conditions. Results presented in these graphs represent annual averages. The upgradient well is indicated in each trend graph with an "UP" label. All remaining wells are downgradient from the

monitored waste management unit. These types of graphs are especially valuable because they condense a lot of information into a concise, easily understandable format. The graphs show how the particular parameter changed within a given well over time and how the different wells within the specific waste management unit compare to each other. For example, Figure 3-6a shows pH data from 1986 through 1990 for selected wells monitoring the low-level waste treatment facility. It can be observed that there has been little change in pH over time for these wells and that the differences between wells has remained constant (as one looks from front to back within the same year). In this particular figure the upgradient well is shown in the middle of the graph.

In contrast, Figure 3-12 presents some interesting downward trends for averaged tritium concentrations for wells monitoring the high-level waste storage and processing area and the former construction and demolition debris landfill.

Trend graphs for the low-level waste treatment facility wells are subdivided into two five-year trend graphs per parameter in order to enhance presentation, because only six wells can be included on a given graph.

- Statistical Treatment of Groundwater Data

A third way in which results from various environmental monitoring programs may be evaluated is by using appropriate statistical tests. In this case, groundwater contamination indicator parameters (pH, conductivity, total organic carbon, total organic halogens, nitrate, tritium, gross alpha, and gross beta) were evaluated using a statistical procedure called the Analysis of Variance, or ANOVA. The ANOVA technique is a statistical method commonly used to compare several population means. The comparison allows the detection of statistically significant differences between various well locations. The tests were performed on the contamination indicator results after they were grouped together on a waste management unit basis. Thus, the results generated by the ANOVA test indicate whether there are significant differences between wells within the given waste manage-

Table 3 - 3

Summary of Groundwater Monitoring Data for the Low-Level Waste Treatment Facility

STATISTICAL DIFFERENCES OBSERVED AT DOWNGRADIENT WELLS COMPARED TO UPGRADIENT WELL WNW86-06

Parameter	WNGSEEP	WNSP008	WNW80-05	WNW80-06	WNW86-03	WNW86-04	WNW86-05
<i>pH</i>	lower	-	-	lower	higher	higher	-
<i>Conductivity</i>	-	-	-	-	-	-	-
<i>TOC</i>	-	-	-	-	-	-	higher
<i>TOX</i>	-	-	-	-	-	-	-
<i>Tritium</i>	higher	higher	higher	higher	higher	higher	higher
<i>Gross Alpha</i>	-	-	-	-	-	-	higher
<i>Gross Beta</i>	-	higher	-	-	-	higher	higher
<i>Nitrate-N</i>	higher	higher	higher	-	higher	higher	-

Note: A decrease in value is reported only for pH.

ment unit. Significant differences, once discovered, are then evaluated to determine if the differences are between upgradient and downgradient well locations. The great value of these statistical tests is that they effectively condense a lot of data.

The results of these statistical analyses are summarized in Tables 3-3 through 3-5 for the low-level waste treatment facility, the high-level radioactive waste tank complex and former construction and demolition debris landfill (the high-level waste storage and processing area), and the NRC-licensed disposal area.

As an example of how to interpret these tables, note that Table 3-3 shows that well location WNW86-05 has elevated levels of total organic carbon, tritium, and gross beta activity when compared to the upgradient well from this location, WNW86-06. A dash within the statistical summary table indicates that the downgradient well is indistinguishable from the upgradient well for the given parameter.

These tables show only whether a downgradient well has a higher concentration for a given parameter (both higher and lower for pH) than the upgradient well for that particular waste management unit. It is important to note that these tables do not provide information about trends or whether the concentration at a particular sampling location is rising or falling over time.

The ANOVA procedure also provides the option for generating confidence interval plots for each of the contamination indicator parameters on a waste management unit basis. These plots are shown in Appendix E in Figures E-1 through E-26 for all the parameters shown in Tables 3-3 through 3-5.

In some cases, before using the ANOVA technique, the data set was manipulated by taking the logarithm of the values. This process, called a log-transformation, is sometimes performed for data sets that do not fit the normal, or bell-shaped, distribution. Using the ANOVA technique on log-transformed data was sometimes necessary to ensure the validity of the

results from the statistical tests, since the ANOVA technique requires data sets that approximate a normal distribution. In cases where the log-transformation technique was used, the confidence interval plots, shown in Appendix E, were still derived from the non-transformed data because of the difficulty associated with interpreting graphs of the data set logarithms. In all cases where log-transformations were used, the conclusions shown in the statistical summary tables were more conservative than the non-transformed data.

The ANOVA statistical procedure is recommended by the United States Environmental Protection Agency (1989) as an appropriate method for evaluating statistically significant differences between upgradient and downgradient groundwater monitoring locations. It is important to keep in mind, however, that although a significant difference between sampling locations may exist, that difference is not always directly attributable to the waste management unit. For example, natural variability in soil geochemistry could contribute to differences between groundwater pH or conductivity, which may or may not be related to the waste management unit. In general, any particular data evaluation method should be viewed as a tool for data interpretation and not an end in itself. It is always important to ensure that the results of a particular data analysis test are supported by visually examining the data.

3.3.2 Significance of Waste Management Unit Monitoring Data

■ Low-level Waste Treatment Facility (SSWMU #1)

Table 3-3 summarizes the results of the ANOVA procedure performed on data obtained from 1990 groundwater monitoring at sample locations around the low-level waste treatment facility. As such, this table indicates where there is an indication of groundwater contamination. Several items within Table 3-3 are noteworthy.

Only two locations were shown to have a significantly higher pH than the upgradient well location. These differences may be observed by looking at the five-year trend graphs for pH (Figures 3-6a and 3-6b). In looking at these

graphs it can be seen that these differences are relatively minor and that they appear consistent from one year to the next.

The results for conductivity indicate that none of the downgradient wells are higher than upgradient well WNW86-06. This fact can be seen quite readily by looking at Figures 3-7a and 3-7b for averaged conductivity over the past five years. All the wells, with the exception of the upgradient well, are shown to be relatively stable over time. The variation seen for conductivity in the upgradient well is attributable to its position downgradient of the sludge ponds. The sludge ponds are or have been used as settling basins for various non-radiological process streams. These streams include regeneration backflushing of the Project's demineralized water system's ion exchange columns. The backflushing contributed significant salt loading to these settling basins and so could influence the conductivity of groundwater in the immediate area.

Another noteworthy item is the elevated levels of tritium and gross beta activity shown for many of the downgradient wells within this monitored unit. The five-year trend graphs for tritium are shown in Figures 3-8a and 3-8b. As in past years, well WNW86-05 continues to show the highest levels of tritium for any of the wells monitored within this unit.

Figures 3-9a and 3-9b show five-year trend results for gross beta activity for wells within the low-level waste treatment facility area. Well WNW86-05 shows the highest levels of gross beta activity for any well monitored routinely during 1990. Location WNW86-05 is the only on-site well, routinely monitored during 1990, with gross beta activity exceeding the New York State groundwater quality standard of $1 \text{ E-}06 \mu\text{Ci/mL}$.

As discussed in previous site environmental reports (WVNS 1987, 1988, and 1989), well WNW86-05 is located at the downgradient edge of former Lagoon 1. Lagoon 1 was taken out of service in 1984 because it was identified as a likely source of groundwater contamination within the localized area. At times Lagoon 1 contained water with tritium activity as high as $1\text{E-}01 \mu\text{Ci/mL}$. Although

Table 3 - 4

Summary of Groundwater Monitoring Data for the High-level Waste Storage and Processing Area

STATISTICAL DIFFERENCES OBSERVED AT DOWNGRADIENT WELLS COMPARED TO UPGRADIENT WELL WNW80-02

Parameter	WNW86-07	WNW86-08	WNW86-09	WNW86-12*	WNDMPNE*
<i>pH</i>	lower	lower	lower	lower	lower
<i>Conductivity</i>	higher	-	higher	higher	higher
<i>TOC</i>	-	higher	-	-	higher
<i>TOX</i>	-	-	-	-	-
<i>Tritium</i>	-	-	higher	higher	higher
<i>Gross Alpha</i>	-	-	-	-	-
<i>Gross Beta</i>	higher	higher	higher	-	higher
<i>Nitrate-N</i>	-	-	-	-	-

Note: A decrease in value is reported only for pH.

*Monitoring wells near the former construction and demolition debris landfill.

Lagoon 1 was filled and covered in 1984 it is not considered officially closed.

The five-year trend graphs for tritium and gross beta activity indicate that there are changes occurring over time for wells within this unit. However, differences between well locations generally exceed those changes for a given parameter within the well through time, indicating that changes in groundwater quality do not generally occur rapidly.

■ **High-level Waste Storage and Processing Area (SSWMU #4)**

Table 3-4 summarizes the statistically significant differences between upgradient and downgradient wells within the high-level waste storage and processing area and the construction and demolition debris landfill. As indicated in the summary table, pH is lower and conductivity higher in most downgradient monitoring wells. This is also evident when

looking at the five-year trend graphs (Figs.3-10 and 3-11) for these monitoring parameters. It is interesting to note that there are several downward trends evident for conductivity, especially at well locations WNW86-07 and WNW86-08. In fact, conductivity at well location WNW86-08 was indistinguishable from concentrations in the upgradient well, WNW80-02. These long-term reductions in conductivity suggest a general improvement in chemical groundwater quality in the vicinity of the high-level waste tank complex.

Other differences between upgradient and downgradient wells within the high-level waste storage and processing area and the construction and demolition debris landfill are summarized in Table 3-4. As indicated, there are several downgradient wells that differ from upgradient well WNW80-02. Figures 3-12 and 3-13 show the five-year trend graphs for tritium and gross beta concentrations for all wells within these areas. For tritium, as for conductivity, there are wells that show downward

trends over time – for example, WNW86-08 and WNW86-12. The trend graphs for gross beta results show a more stable situation with the exception of well WNW86-09, which has shown a steady rise in gross beta concentrations since monitoring began in 1986. Differences in mobility between tritium, which moves with the groundwater, and other beta-emitting isotopes are known to exist for groundwater systems (Sheppard et al. 1990). For example, isotopes such as cesium-137 and strontium-90 tend to bind significantly with soil so that their mobility within a groundwater system may be retarded. Differences in a specific isotope's mobility may be partly responsible for differences in the shape of the five-year trend graphs.

The gross beta activity measured at well WNW86-09, although below New York State's groundwater quality standard of $1E-06 \mu\text{Ci/mL}$, may indicate a continuing source of contamination upgradient of this well. Other parameters such as pH, conductivity, and tritium do not appear to be changing significantly at location WNW86-09. During the installation of new 90-series wells at areas downgradient of the main process building, other areas of elevated gross beta activity were encountered at depths similar to the 28-foot depth of well WNW86-09. During the installation of these new wells the contamination was observed to be localized at this depth rather than continuous from the surface downward (Dames & Moore 1991). This contamination may be related to current conditions within the main process building and will be the focus of attention as expanded monitoring of the new 90-series wells continues in 1991. The results of groundwater monitoring carried out within the high-level waste storage and processing area, combined with measurements of water collected within the immediate vicinity of the high-level waste tanks, continue to provide evidence supporting the integrity of the high-level waste tanks.

■ **NRC-licensed Disposal Area (NDA)
(SSWMU #9)**

Table 3-5 presents the summary statistics for the groundwater contamination indicator parameters for wells monitoring the NRC-

licensed disposal area (NDA). Groundwater monitoring at this area is focused upon the lacustrine silt and sand deposits. Although minor differences are noted between upgradient and downgradient wells within this monitoring unit these differences appear unrelated to the wastes stored within the disposal area. The most convincing evidence for this is that tritium concentrations for both the upgradient and downgradient wells have been at or near the detection limit since monitoring began in 1986. Figures 3-14 through 3-17 show the five-year trend graphs for the NRC-licensed disposal area.

**3.3.3 Summary of Initial Sampling
of 90-Series Wells**

After the development process was completed for the newly installed 90-series wells, specified super solid waste management units (SSWMUs) were selected for initial sampling. Selection was based upon the need to expand monitoring in areas already monitored or in which monitoring was not currently occurring. The SSWMUs selected for initial monitoring included the low-level waste treatment facility (SSWMU #1); the chemical process cell waste storage area (SSWMU #7); and the construction and demolition debris landfill (SSWMU #8). Selection of these SSWMUs added twenty-three groundwater monitoring locations to the schedule for sample collection in December 1990. The parameters scheduled for collection from these wells included pH, conductivity, gross alpha, gross beta, and tritium.

Table E-15, in Appendix E, presents the results for initial sampling of wells monitoring the SSWMUs discussed above. Although Table E-15 provides results for only one sampling period, several of the results from these new wells are noteworthy. Of particular concern are the high pH (12.33) and conductivity ($16,520 \mu\text{mhos/cm}@25^{\circ}\text{C}$) values associated with well WNW0103. These values represent the highest pH and conductivity levels for any well currently monitored on-site. This well, which serves as an upgradient well for SSWMU #1, is in the vicinity of a spill of caustic sodium hydroxide (NaOH) that occurred on-site in 1984. Based on these high pH and conductivity values, it is apparent that this

Table 3 - 5

Summary of Groundwater Monitoring Data for the NRC-licensed Disposal Area (NDA)

STATISTICAL DIFFERENCES OBSERVED AT DOWNGRADIENT WELLS COMPARED TO UPGRADIENT WELL WNW83-1D

Parameter	WNW86-10	WNW86-11	WNW82-1D
<i>pH</i>	-	-	dry
<i>Conductivity</i>	higher	higher	dry
<i>TOC</i>	-	-	dry
<i>TOX</i>	-	-	dry
<i>Tritium</i>	-	-	dry
<i>Gross Alpha</i>	-	-	dry
<i>Gross Beta</i>	higher	-	dry
<i>Nitrate-N</i>	-	-	dry

Note: A decrease in value is reported only for pH.

well has intercepted water differing substantially from normal site groundwater. The extent of the spread of this material is unknown. However, the caustic material is not being detected in any other wells monitored in this unit, based upon observations of pH and conductivity data.

Well WNW0111, which is also within SSWMU#1, showed levels of gross beta activity (3.39 +/- 0.04E-06 $\mu\text{Ci/mL}$) exceeding all the other monitored 90-series wells by at least a factor of ten. This well is positioned at the downgradient edge of former Lagoon 1 and appears to be intercepting groundwater of a quality similar to that of well WNW86-05. Two more new 90-series wells (WNW0104 and WNW0801) showed elevated levels of gross beta activity in the E-7 $\mu\text{Ci/mL}$ range. Continued monitoring of these new wells, combined with the expanded monitoring of all of the new 90-series wells, will help better identify and characterize areas of both chemical and radiological contamination within the groundwater at the West Valley Demonstration Project.

INITIAL SAMPLING OF 90-SERIES WELLS IN THE NEW YORK STATE-LICENSED DISPOSAL AREA (SDA)

In addition to the initial sampling of the twenty-three new 90-series wells discussed above, twenty-one new 90-series wells monitoring the SDA were sampled during 1990. Results for these initial samples are shown in Appendix E, Table E-16. The most notable results are those for well WNW1107A, which showed tritium concentrations in the low E-05 $\mu\text{Ci/mL}$ range. This exceeds the tritium concentration in most of the other SDA wells monitored by at least a factor of 100.

Results of groundwater monitoring in the SDA will be routinely reported to New York State Energy Research and Development Authority personnel responsible for this area. Further evaluation of data from these sampling locations may be useful only after additional sampling has been carried out.

MONITORING OF OTHER 90-SERIES WELLS

During 1991 the entire new groundwater monitoring network will be brought completely on-line for sampling. This expanded network and the use of new sampling equipment, such as well-dedicated bladder pumps, will result in a significant amount of new groundwater monitoring data for the West Valley Demonstration Project. This new information will be invaluable for beginning to fully understand and characterize the site's groundwater resources.

3.3.4 Other Supporting Wells Monitored On-Site

On-site supporting wells are those wells that are not part of the waste management unit monitoring program. These wells, which were monitored on a semiannual basis during 1990, were installed primarily to measure groundwater elevations. They will be phased out of the groundwater sampling program in 1991 as new 90-series wells, meeting all regulatory requirements for groundwater sample collection, are brought on-line.

Data resulting from sample collection from these wells (shown in Appendix E, Table E-1) are generally consistent with past observations. Elevated levels of tritium in well WNW82-4A1 continued to be detected. As discussed in previous site environmental reports (WVNS 1989) it is believed that tritium at this well is related to the placement of this well within a filled excavation made by Nuclear Fuel Services in constructing a ramp in order to aid in the disposal of a large dissolver vessel into Special Hole 9 (SH 9) in the then-active NRC-licensed disposal area (NDA). In addition to the installation of new 90-series wells to monitor this area, an interceptor trench has been installed around the downgradient edges of the NDA to collect contaminated groundwater from the NDA so it can be treated.

The continued detection of elevated levels of gross beta activity at well WNW80-03, on the north plateau, is also consistent with past monitoring results. The position of this well is downgradient of a former contaminated hardstand area and the main process plant

facilities. The depth of this well, 8.0 feet, and the lack of significant tritium activity suggests a possible tie to localized surface contamination.

3.3.5 Groundwater Monitoring at the Below-grade Fuel Storage Area

Table E-2 in Appendix E presents the results from groundwater monitoring well WNW86-13, located near the below-grade gasoline and diesel fuel storage area. Results for the selected volatile organic compounds benzene, toluene, and xylene continue to provide evidence for the integrity of these underground storage tanks.

3.3.6 Comparison of Data to New York State Groundwater Quality Standards

Data tables E-3 through E-14 in Appendix E present the New York State Groundwater Quality Standards for Class GA waters for parameters measured by the West Valley Demonstration Project's groundwater monitoring program. These standards are derived from Title 6 of the New York Code of Rules and Regulations (NYCRR), Chapter X, Part 703.5. Water meeting these standards is acceptable for use as a source of drinking water. These standards provide a conservative reference for comparison to site groundwater data. (Site groundwater is not used either on-site or off-site as a source of drinking water.)

Comparing 1990 site groundwater data to these quality standards reveals the following noteworthy items: With the exception of well WNW86-05, all waste management unit wells meet the New York State quality standards for the radiological parameters monitored. Well WNW86-05, however, regularly exceeds the quality standard for gross beta activity and exceeded the tritium quality standard for one of eight samples collected. This well and its location at the downgradient edge of former Lagoon 1 was discussed in section 3.3.2. As in 1989, no other wells that were part of the existing waste management unit program during 1990 exceeded groundwater quality standards for gross alpha, gross beta, or tritium. For new 90-series wells monitored during 1990 it is apparent that well WNW0111, also near the downgradient edge of former

Lagoon 1, also exceeds the gross beta groundwater quality standard.

For wells monitoring the New York State-licensed disposal area (SDA), the tritium groundwater quality standard is exceeded at location WNW1107A. The gross alpha result at this location reported for the sample collected on December 18, 1990 is virtually at the gross alpha quality standard of $1.5 \text{ E-}08 \mu\text{Ci/mL}$. However, there is a relatively large counting uncertainty associated with this result. Future sampling and analysis at this particular location will be necessary to help evaluate this parameter.

For supporting groundwater wells monitored during 1990, tritium concentrations for well WNW82-4A1, discussed above in section 3.3.4, represent the only significant exceedance of a quality standard for this grouping of wells.

A comparison of existing waste management unit groundwater monitoring data to the chemical groundwater quality standards suggests a definite site effect at location WNW86-06. Elevated levels of sodium and chloride at this location are believed to be due to the operation of the nonradioactive sludge ponds (as discussed in section 3.3.2). Results for pH fall marginally below the lower pH threshold of 6.5 at locations WNGSEEP, WNW80-06, WNW86-06, and WNW86-07. For new 90-series wells monitored during 1990, well WNW0103, with a pH of 12.33, represents the only location exceeding the quality standard range of 6.5 to 8.5 (see section 3.3.3).

The above instances in which groundwater quality standards were exceeded are believed due, in part, to past or present activities at the site. In all cases the reported concentrations are also significantly different from background concentrations.

Other instances in which groundwater quality standards are exceeded were observed at other locations. However, these are not believed directly attributable to site activities. They include elevated levels of naturally occurring sodium, iron, and manganese in both upgradient and downgradient samples. Elevated levels of some other metals (for ex-

ample, lead at location WNW86-10) were present in unfiltered samples only. Samples that were collected from the same location and filtered confirmed the lack of these constituents. These sporadic exceedances of quality standards on unfiltered samples only is attributable to the incorporation of sediments and well fines into the samples. The data, taken in total, suggest that all EPA interim primary drinking water standards for trace metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag) are met when natural solid materials are excluded from groundwater samples.

Other sporadic instances in which analytical results exceeded quality standards are believed related to inadequate analytical processes. Included in this category are the results for phenols, in which the analytical detection limit of the method employed exceeds the stringent groundwater quality standard of 0.001 mg/L. Other instances include occasional positive results for elements such as mercury. These occasions are generally observed to affect an entire analytical data set, suggesting a problem during the performance of the analysis.

Continued improvements in the selection of analytical laboratories, in data validation processes, and in the interpretation of analytical results will help in the continued successful evaluation of an increasing amount of groundwater monitoring data.

3.3.7 Off-Site Groundwater Monitoring

During 1990 all of the off-site groundwater residential wells were sampled for radiological constituents, pH, and conductivity. These wells are used by site neighbors as sources of drinking water. There continues to be no evidence indicating contamination of these off-site water supplies by the WVDP. Results for these samples are found in Table C-1.8 in Appendix C.

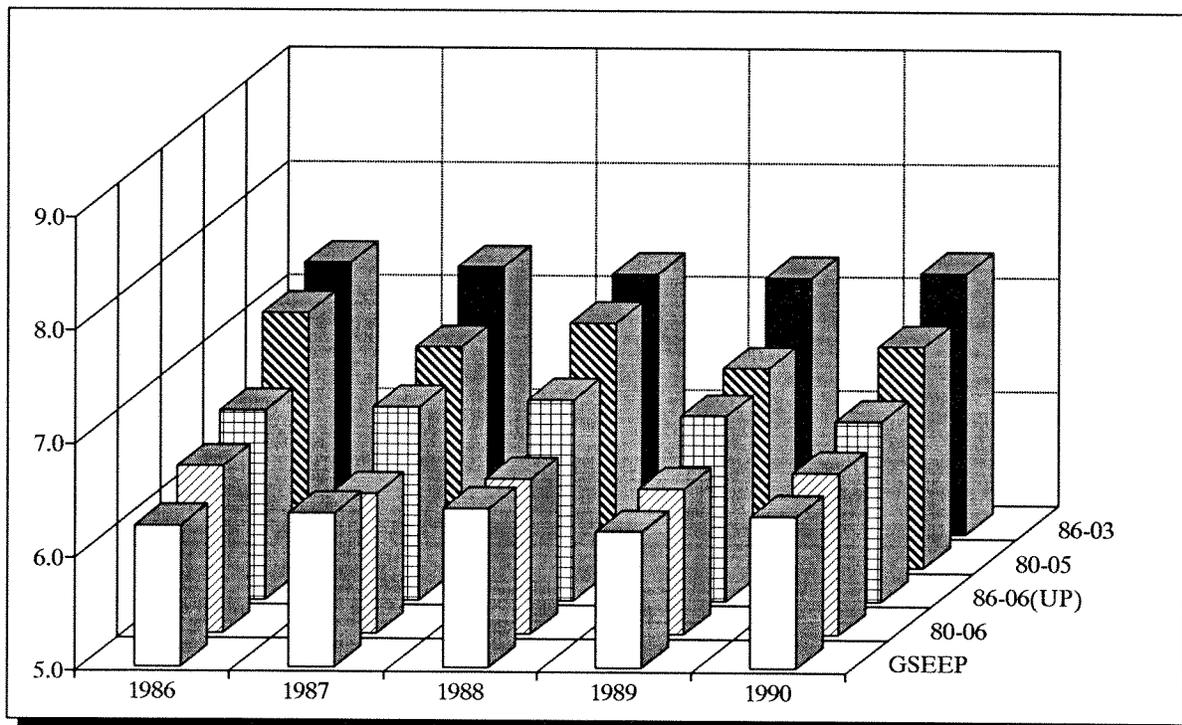


Figure 3-6a. *Five-Year Trend of Averaged pH in Selected Low-Level Waste Treatment Facility Wells.*

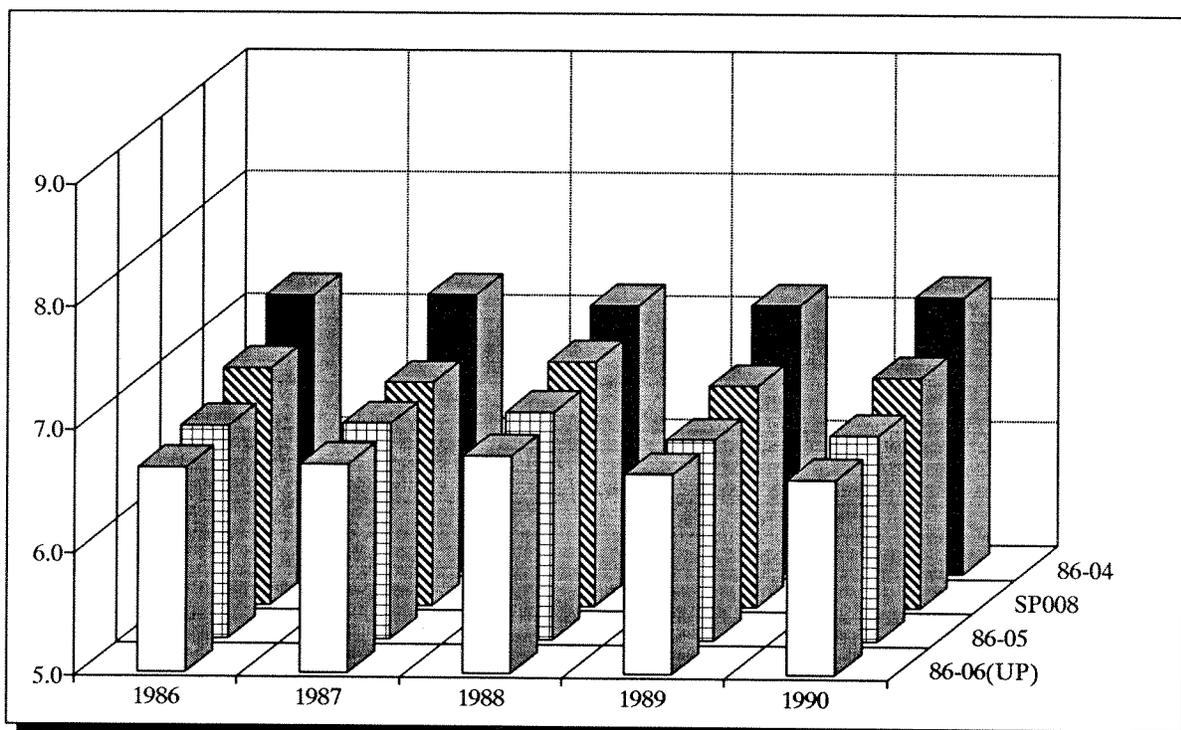


Figure 3-6b. *Five-Year Trend of Averaged pH in Selected Low-Level Waste Treatment Facility Wells.*

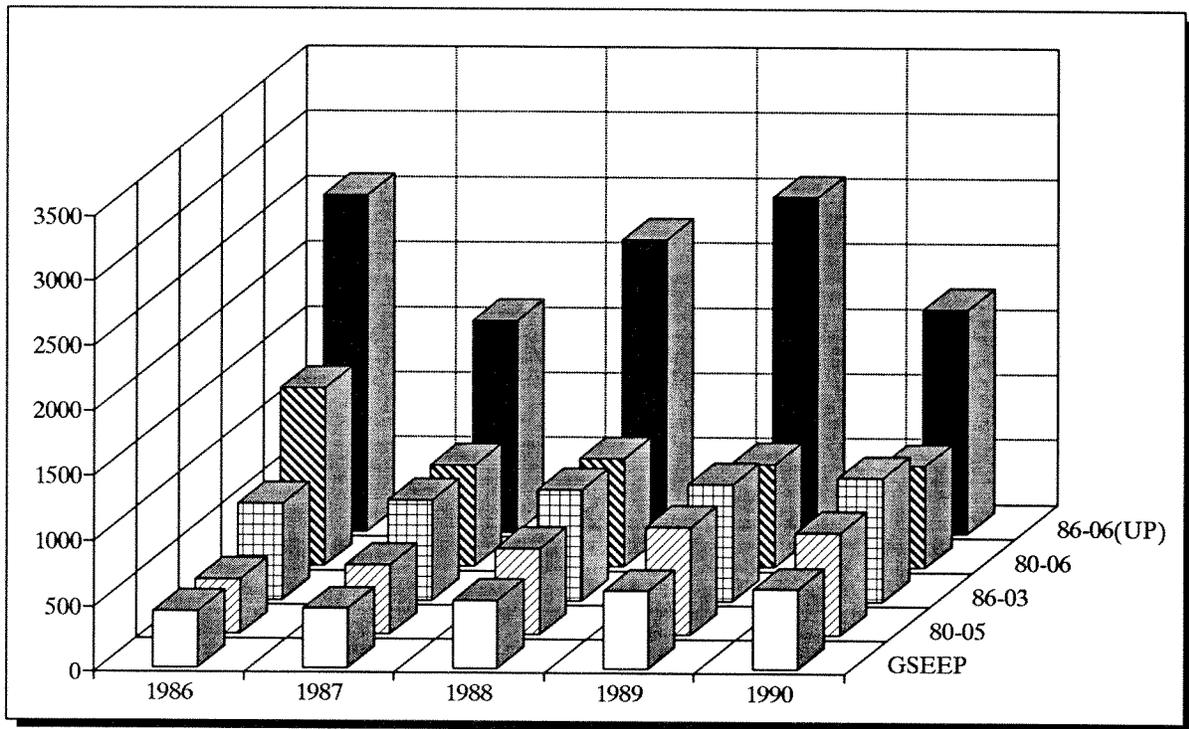


Figure 3-7a. *Five-Year Trend of Averaged Conductivity (umhos/cm) in Low-Level Waste Treatment Facility Wells.*

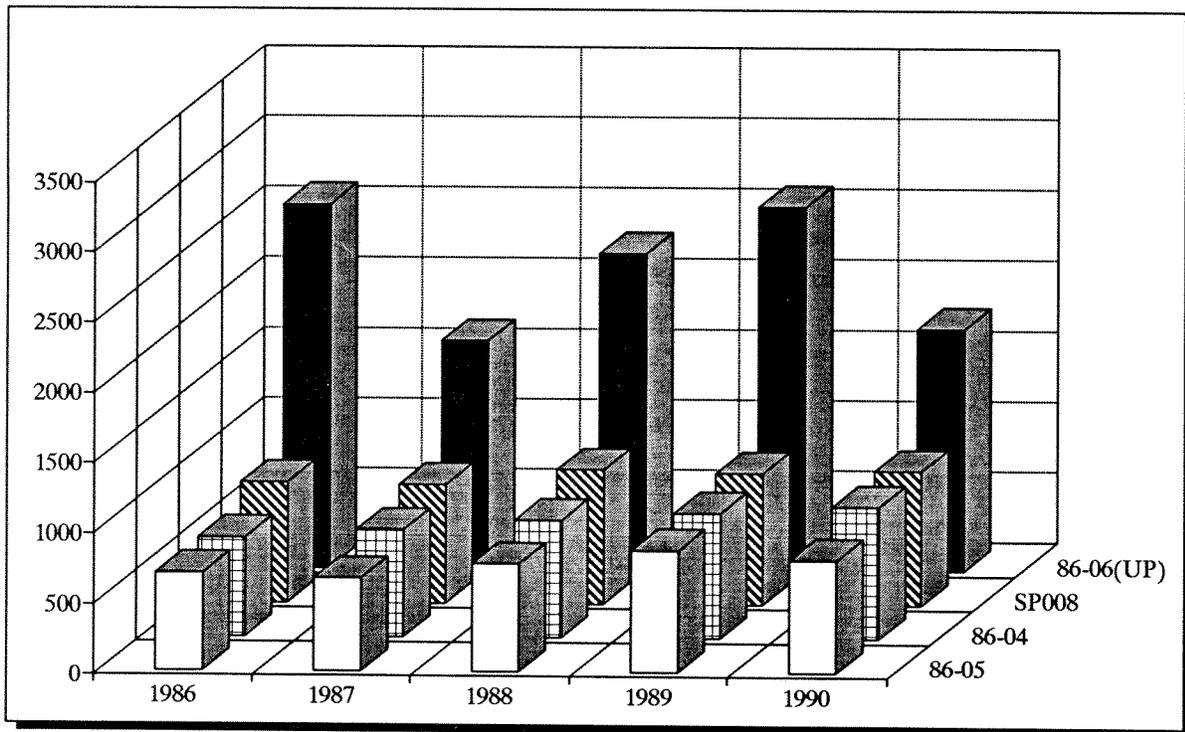


Figure 3-7b. *Five-Year Trend of Averaged Conductivity (umhos/cm) in Low-Level Waste Treatment Facility Wells.*

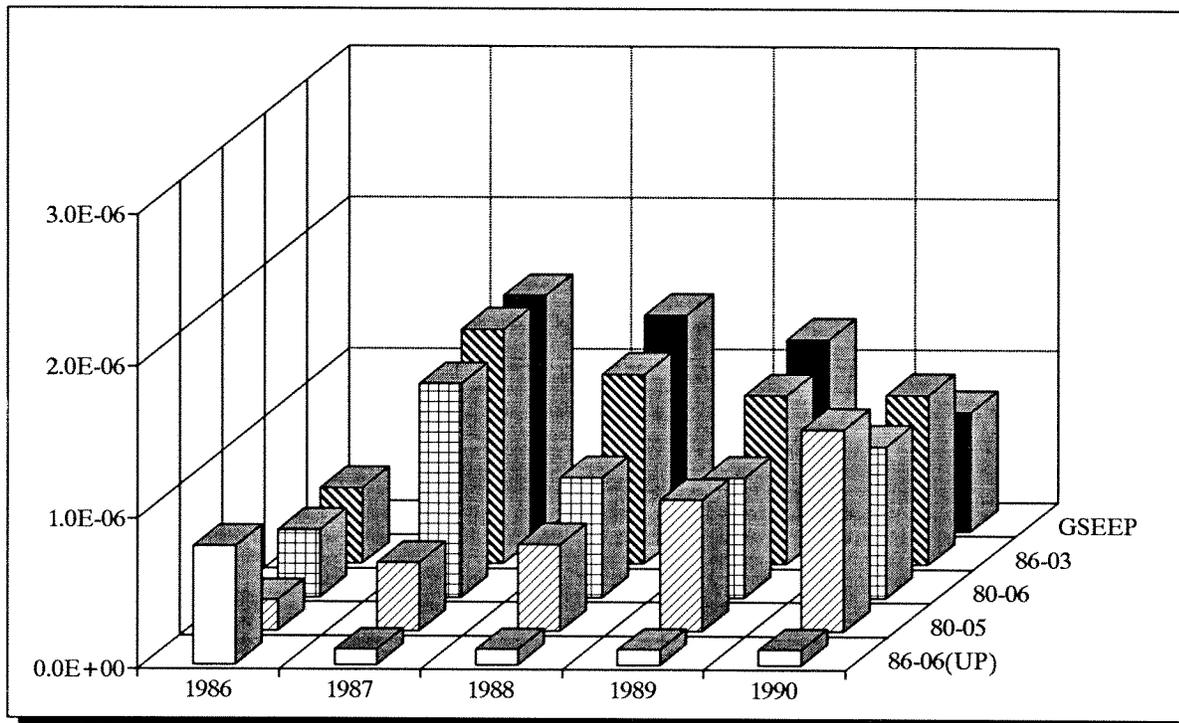


Figure 3-8a. *Five-Year Trend of Averaged Tritium Activity (uCi/ml) in Low-Level Waste Treatment Facility Wells.*

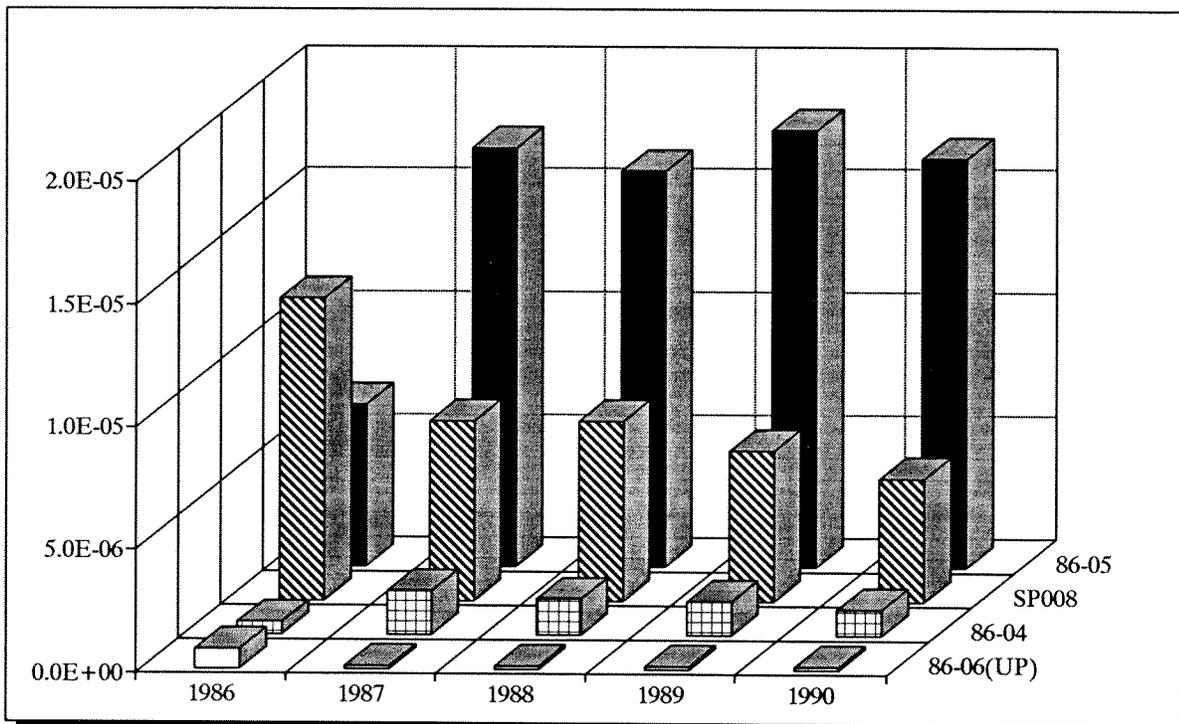


Figure 3-8b. *Five-Year Trend of Averaged Tritium Activity (uCi/ml) in Low-Level Waste Treatment Facility Wells.*

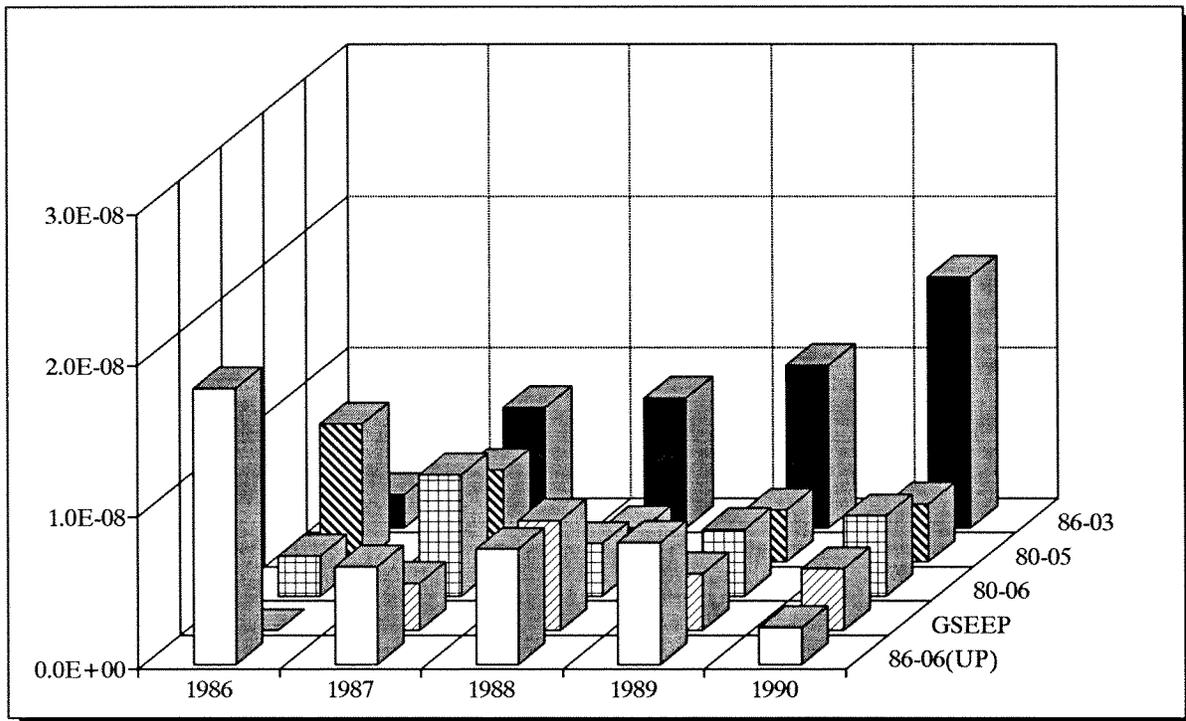


Figure 3-9a. *Five-Year Trend of Averaged Gross Beta Activity (uCi/ml) in Selected Low-Level Waste Treatment Facility Wells.*

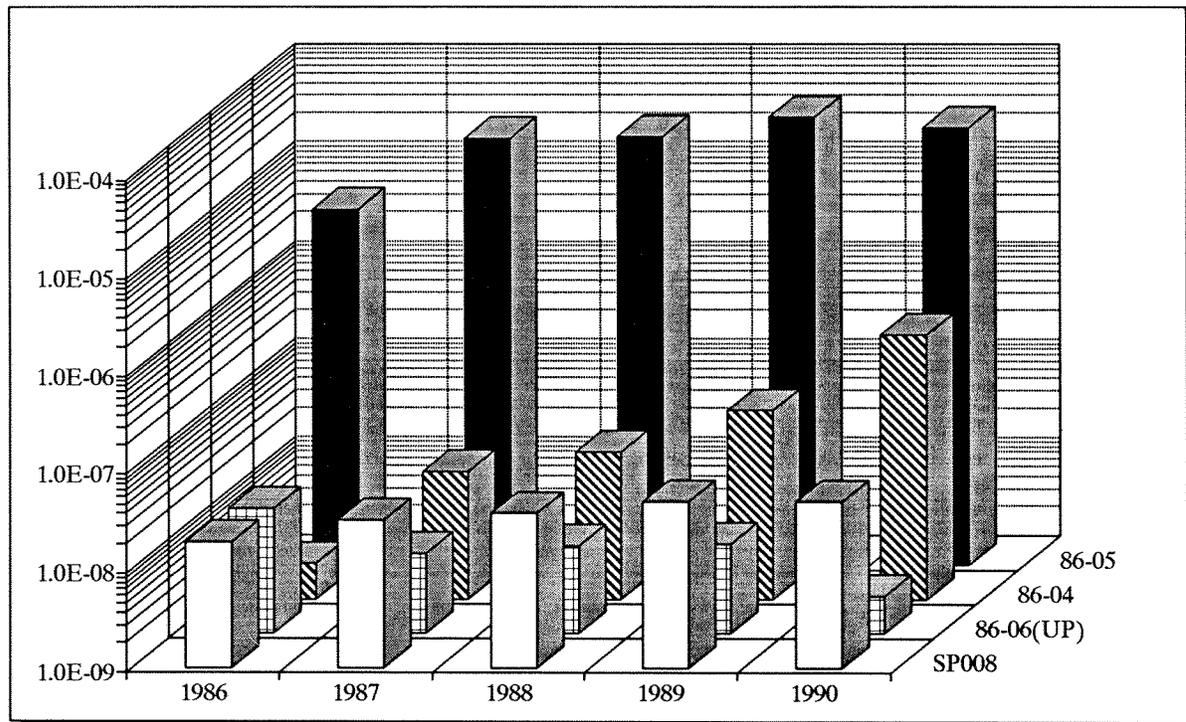


Figure 3-9b. *Five-Year Trend of Averaged Gross Beta Activity (uCi/ml) in Selected Low-Level Waste Treatment Facility Wells. (Note Log Scale).*

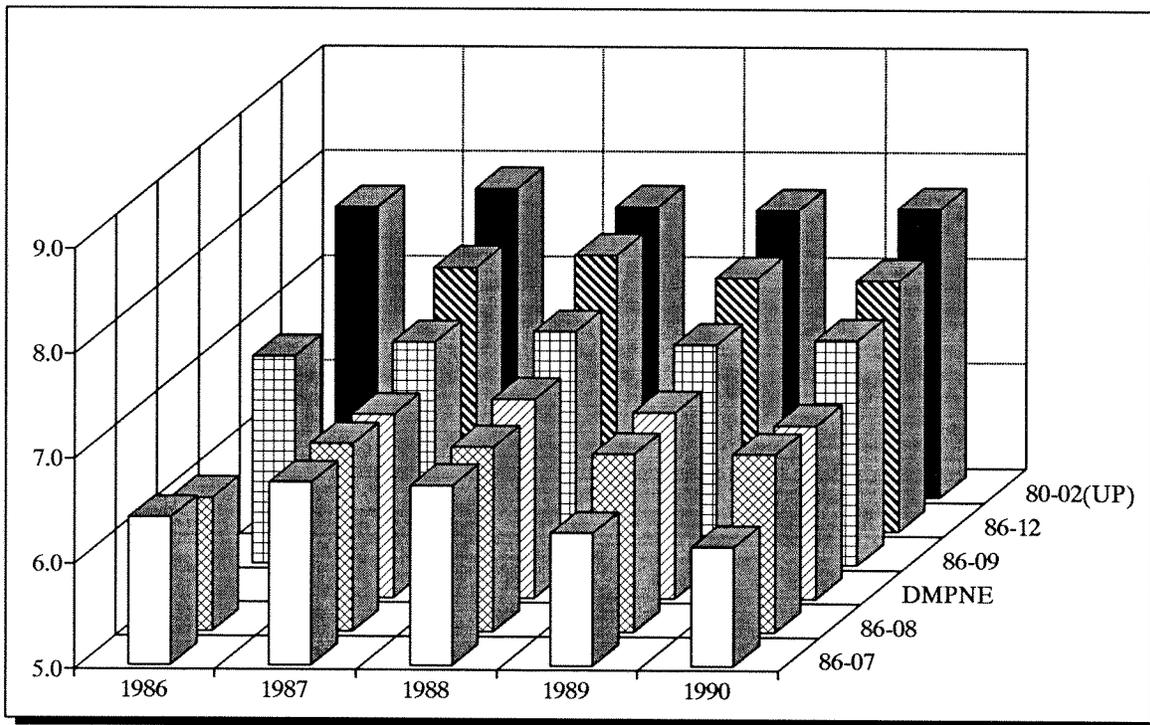


Figure 3-10. *Five-Year Trend of Averaged pH in High-Level Waste Storage and Processing Unit Wells.*

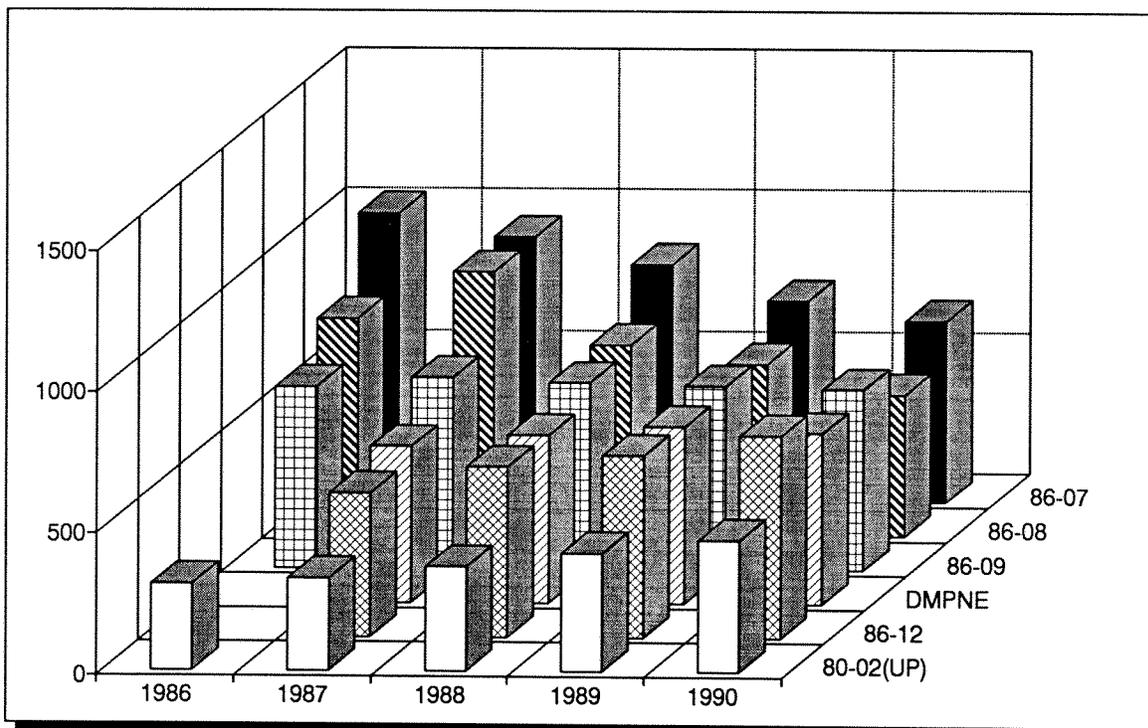


Figure 3-11. *Five-Year Trend of Averaged Conductivity (umhos/cm) in High-Level Waste Storage and Processing Unit Wells.*

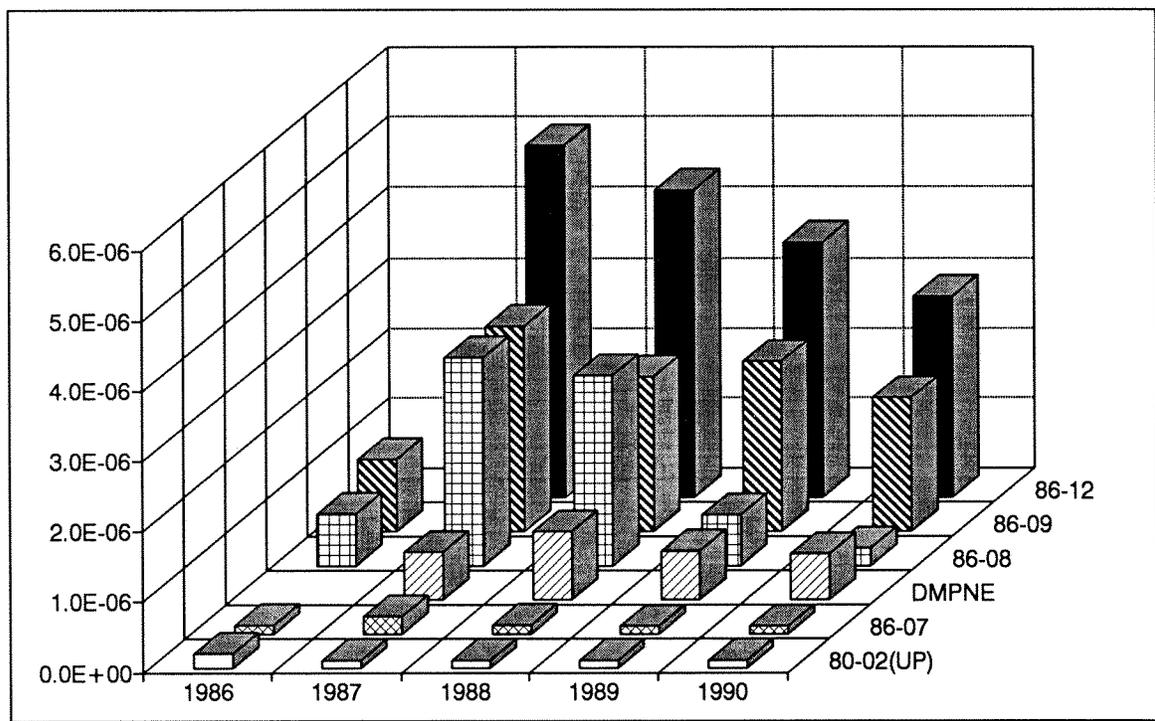


Figure 3-12. *Five-Year Trend of Averaged Tritium Activity (uCi/ml) in High-Level Waste Storage and Processing Unit Wells.*

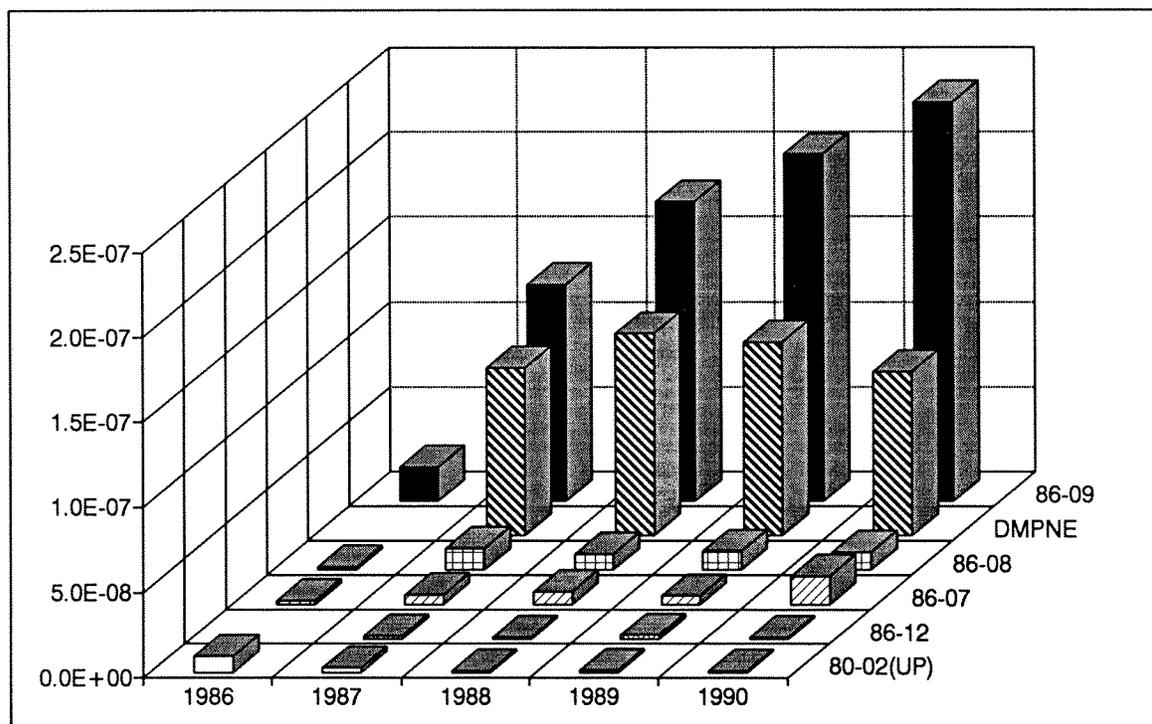


Figure 3-13. *Five-Year Trend of Averaged Gross Beta Activity (uCi/ml) in High-Level Waste Storage and Processing Unit Wells.*

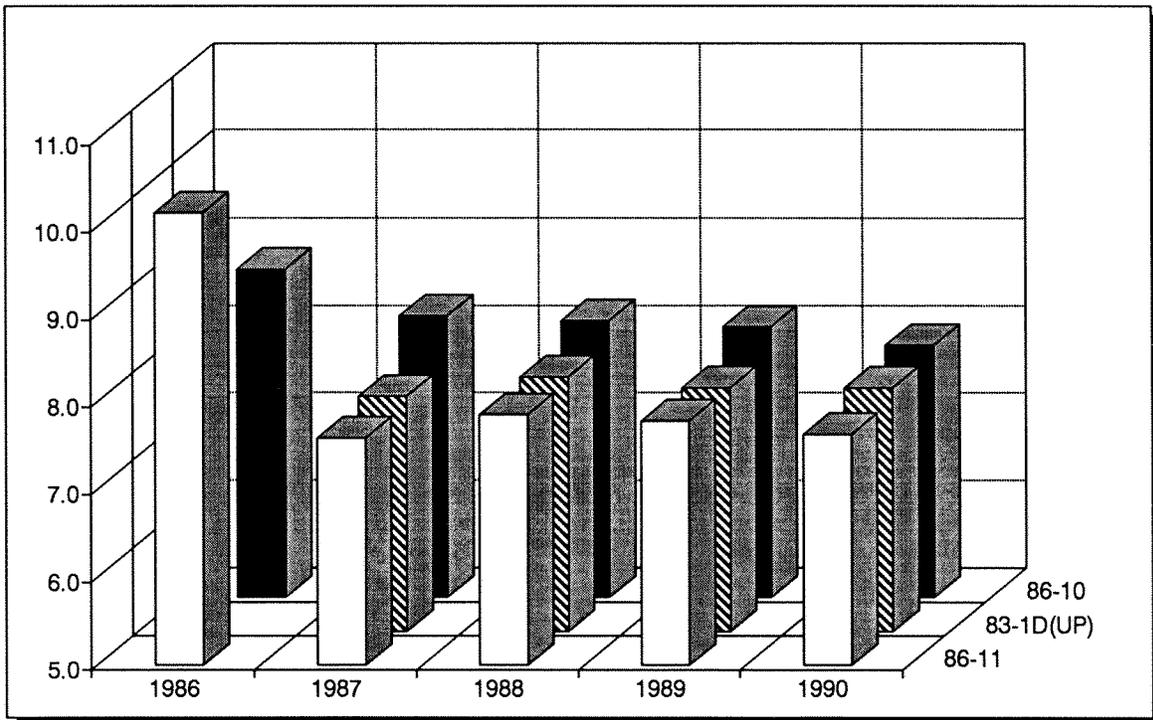


Figure 3-14. *Five-Year Trend of Averaged pH in NRC-Licensed Disposal Area Wells.*

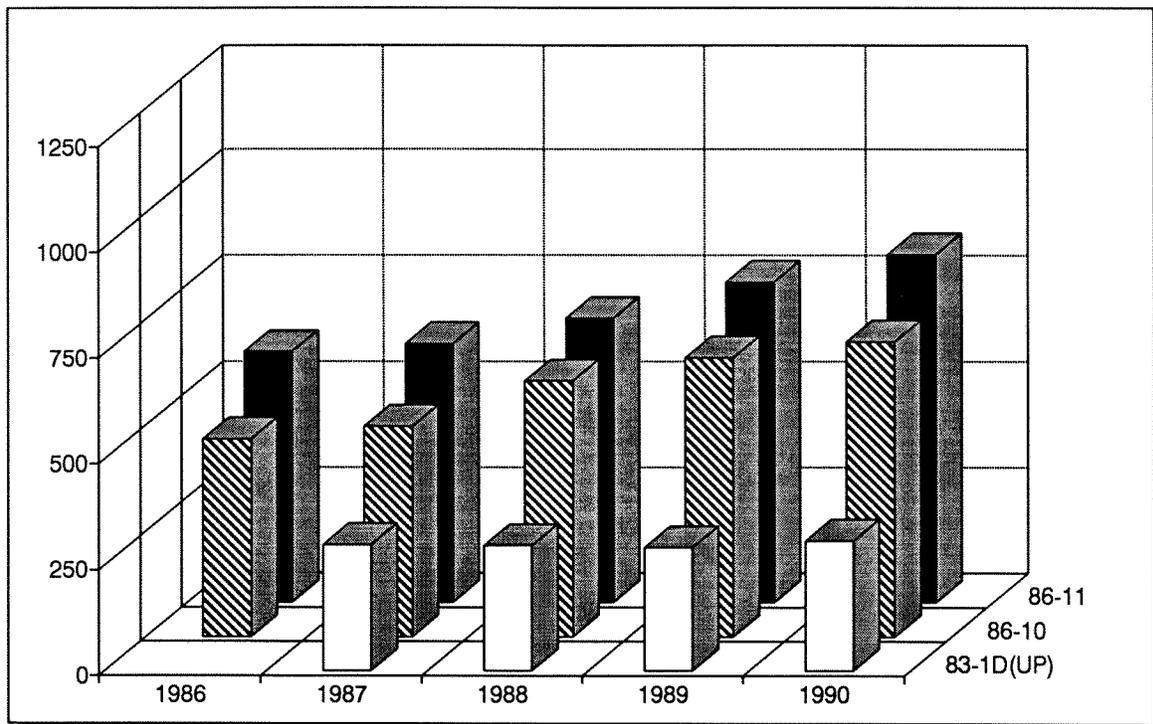


Figure 3-15. *Five-Year Trend of Averaged Conductivity (umhos/cm) in NRC-Licensed Disposal Area Wells.*

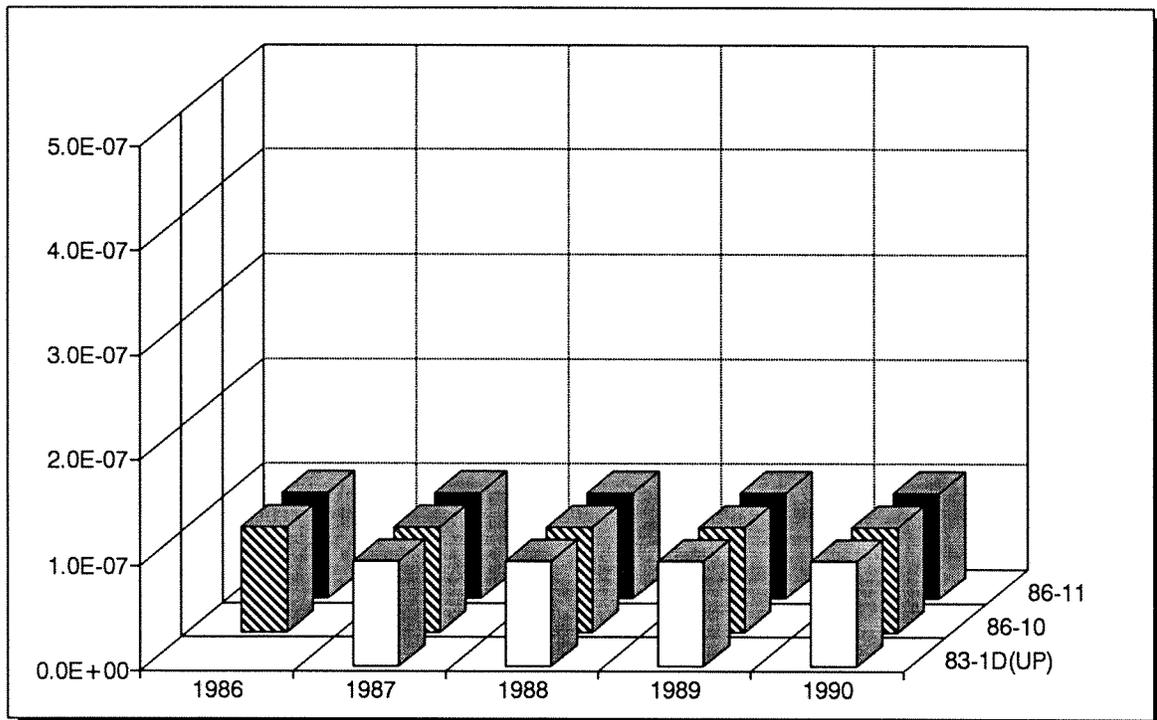


Figure 3-16. *Five-Year Trend of Averaged Tritium Activity (uCi/ml) in NRC-Licensed Disposal Area Wells.*

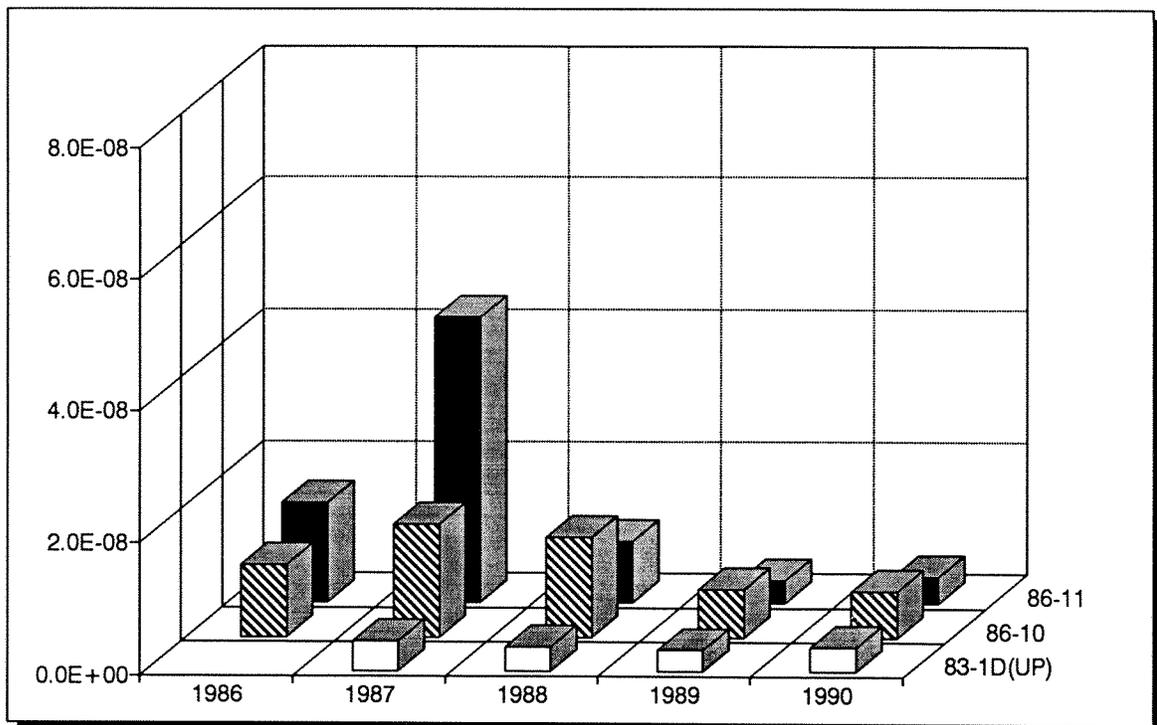
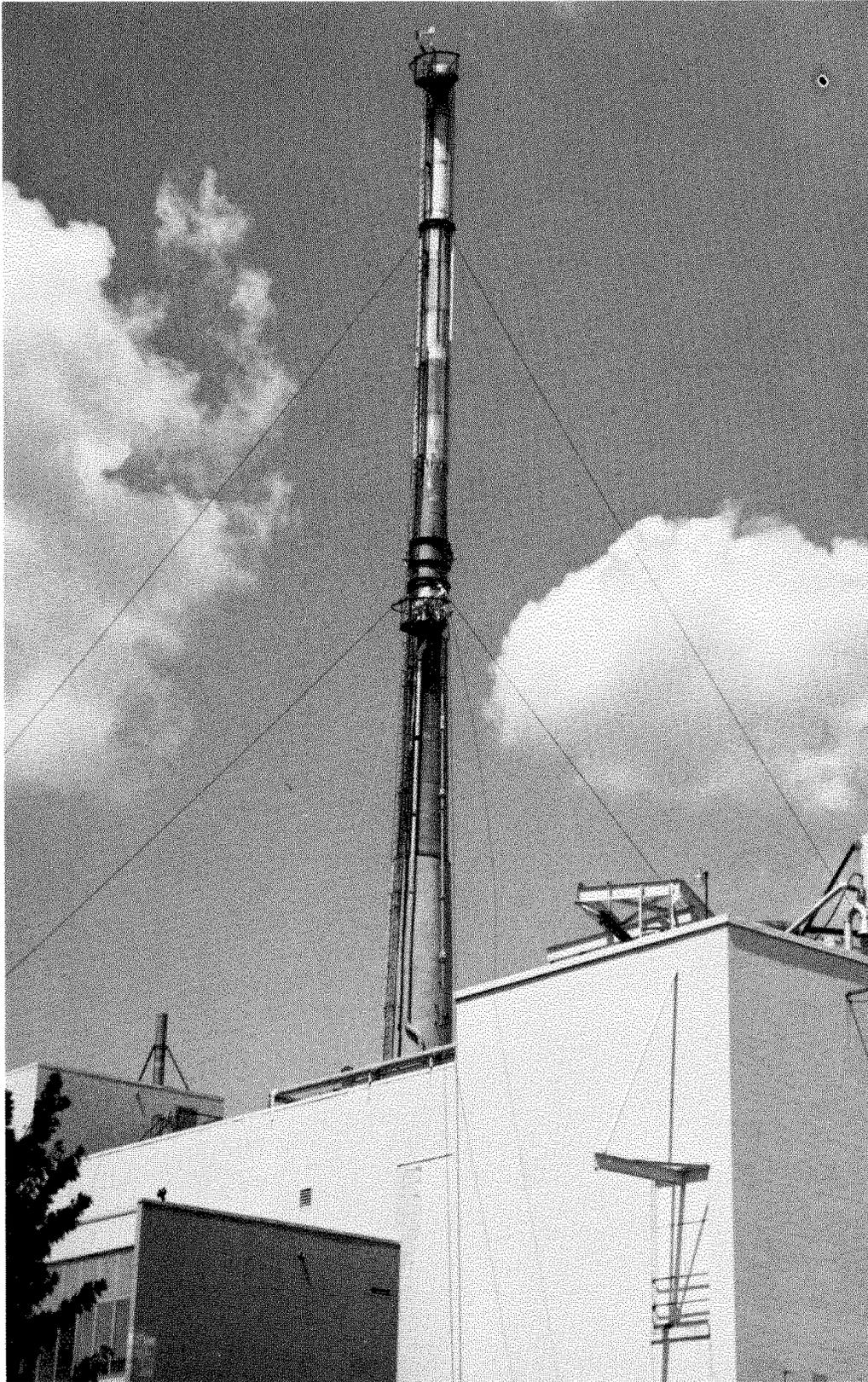


Figure 3-17. *Five-Year Trend of Averaged Gross Beta Activity (uCi/ml) in NRC-Licensed Disposal Area Wells.*



The West Valley Demonstration Project Main Plant Ventilation Stack

4.0 Radiological Dose Assessment

4.1 Introduction

Each year the potential radiological dose to the public from the West Valley site is assessed in order to ensure that no individual could possibly have received an exposure exceeding the limits established by the regulatory agencies. The results of these conservative dose calculations demonstrate that the hypothetical maximum dose to an off-site resident is well below permissible standards and is consistent with the “as low as reasonably achievable” (ALARA) philosophy of radiation protection.

Dose Estimates

This chapter describes the methods used to estimate the dose to the public from radionuclides emitted from the West Valley Demonstration Project through air and water discharges during 1990. The dose estimates, based on concentrations of radionuclides measured in air and water collected from monitored on-site effluent points throughout 1990, are compared to the radiation standards established by the Department of Energy and the Environmental Protection Agency for protection of the public. The radiation doses reported for 1990 are also compared to the doses reported in previous years.

Computer Modeling

Because of the difficulty of measuring the small amounts of radionuclides emitted from the site beyond those that occur naturally in the environment, computer models were used to calculate the environmental dispersion of the radionuclides emitted from monitored ventilation stacks and liquid discharge points on-site.

These models have been approved by the Department of Energy and the Environmental Protection Agency to demonstrate compliance with radiation standards. Radiological dose is evaluated for the three major exposure pathways: external irradiation, inhalation, and ingestion of local food products. The dose contributions from each radionuclide and pathway combination are then summed to obtain the reported dose estimates.

4.1.1 Sources of Radiation Energy and Radiation Exposure

» Radionuclides

Atoms that emit radiation are called radionuclides. Radionuclides are unstable isotopes (variations of an element) that have the same number of protons and electrons as any other isotope of the element but different numbers of neutrons, resulting in different atomic masses. For example, the element hydrogen has two stable isotopes, H-1 and H-2 (deuterium), and one radioactive isotope, H-3 (tritium). The numbers following the element's symbol identify the atomic mass — the numbers of protons and neutrons — in the nucleus.

Once a radioactive atom decays by emitting radiation, the resulting daughter atom may itself be radioactive or stable. Each radioactive isotope has a unique half-life that represents the time it takes for 50% of the atoms to decay. Strontium-90 and cesium-137 have half-lives of about thirty years, while plutonium-239 has a 24,000-year half-life.

» Radiation Dose

The energy released from a radionuclide is eventually deposited in matter encountered

along the path of radiation, resulting in a radiation dose to the absorbing material. The absorbing material can be either inanimate matter or living tissue.

While most of the radiation dose affecting the general public is background radiation, man-made sources of radiation may also contribute to the radiation dose to individual members of the public. Such sources include diagnostic and therapeutic x-rays, nuclear medicine, consumer products such as smoke detectors and cigarettes, fallout from atmospheric nuclear weapons tests, and effluents from nuclear fuel cycle facilities.

The West Valley Demonstration Project is part of the nuclear fuel cycle. The radionuclides present at the site are left over from the recycling of commercial nuclear fuel during the 1960s and early 1970s. A very small fraction of these radionuclides is released off-site annually through ventilation systems and liquid discharges. An even smaller fraction actually contributes to the radiation dose to the surrounding population.

4.1.2 Health Effects of Low Levels of Radiation

The concept of dose equivalent (DE) was developed by the radiation protection community to allow a rough comparison of doses from different types of radiation.

The primary effect of low levels of radiation in an exposed individual appears to be an increased risk of cancer. Radionuclides entering the body through air, water, or food are usually distributed unevenly in different organs of the body. For example, isotopes of iodine concentrate in the thyroid gland. Strontium, plutonium, and americium isotopes concentrate in the skeleton. Uranium and plutonium isotopes, when inhaled, remain in the lungs for a long time. Some radionuclides such as tritium, carbon-14, or cesium-137 will be distributed uniformly throughout the body. Depending on the radionuclide, some organs may receive quite different doses. Moreover, at the same dose levels certain organs (such as the breast) are more prone to developing a fatal cancer than other organs (such as the thyroid).

4.1.3 Dose Estimation Methodology

The International Commission on Radiological Protection (ICRP) found a way to account for this difference in radionuclide distribution and organ sensitivity. In Publications 26 (1977) and 30 (1979), the Commission developed an organ-weighted average dose methodology to limit permissible worker exposures following intakes of radionuclides. This weighting factor — a ratio of the risk from a dose to a specific organ or tissue to the total risk when the whole body is uniformly irradiated — represents the relative sensitivity of a particular organ to develop a fatal effect. For example, to determine the weighting factor following a uniform irradiation, the risk factor of death from cancer of a specific organ is divided by the total risk of dying from cancer of any organ. Organ-weighted dose equivalents are then summed to obtain an effective dose equivalent (EDE).

● Units of Measurement

The U.S. unit of dose equivalent measurement (DE) is the rem. The international unit of measurement of DE is the sievert (Sv), which is equal to 100 rem. The millirem (mrem) and millisievert (mSv) are used more frequently to report the low DEs encountered in environmental exposures.

The National Council on Radiation Protection and Measurements (NCRP) Report 93 (1987) estimates that the average annual EDE received by a person living in the U.S. is about 360 mrem (3.6 mSv) from both natural and manmade sources of radiation (Fig. 4-1). This number is based on the collective EDE, defined as the total EDE received by a population (expressed in units of person-Sv or person-rem). The average individual EDE is obtained by dividing the collective EDE by the population number.

● Risk Estimate

The Committee on Biological Effects of Ionizing Radiations (BEIR) has estimated that the increased risk of dying from cancer from a single acute dose of 10 rem (0.1 Sv) is about 0.8% of the background risk of cancer. According to the BEIR Committee, chronic ex-

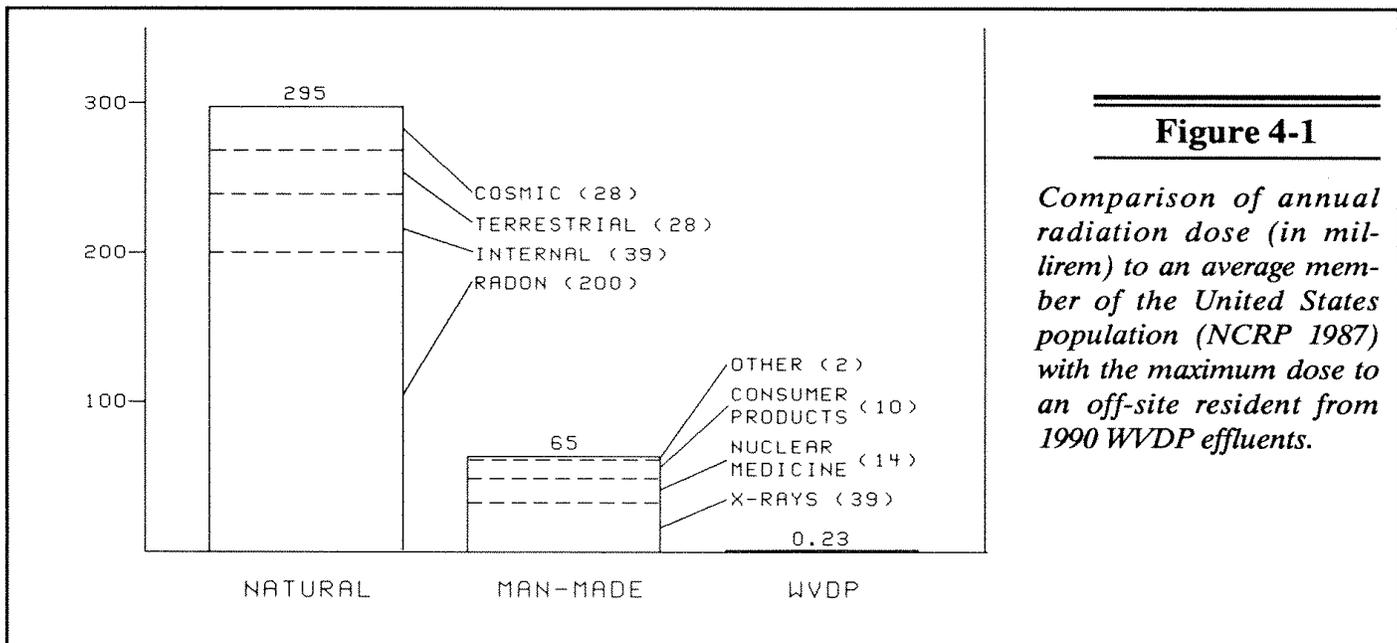


Figure 4-1

Comparison of annual radiation dose (in millirem) to an average member of the United States population (NCRP 1987) with the maximum dose to an off-site resident from 1990 WVDP effluents.

posure, i.e., accumulation of the same dose over long periods of time, might, compared to acute exposure, reduce the risk by a factor of two or more. The background risk of fatal cancers in the United States is currently about one in every eight fatalities.

The BEIR Committee has stressed that the health effects of very low levels of radiation are not clear, and any use of risk estimates at these levels is subject to great uncertainty (BEIR 1990). As will be shown in the following sections, the estimated maximum EDE received by a member of the public from Project activities during 1990 is many orders of magnitude lower than the exposures considered in the BEIR report.

4.2 Estimated Radiological Dose from Airborne Effluents

Sources of Radioactivity from the WVDP

As reported in Chapter 2, "Effluent and Environmental Monitoring," five stacks and vents were monitored for radioactive air emissions during 1990. The activity that was released to the atmosphere from these stacks and vents is listed in Tables C-2.1 through C-2.11 in Appendix C-2.

Because of a delay in receiving some specific quarterly isotopic sample analysis results from the contract laboratory, annual emissions for certain radionuclides had to be estimated to fill in gaps in the data. The estimate was made by applying scaling factors based on past plant emissions (1989 and available 1990 analysis results). As plant processes during 1990 did not vary significantly from the previous year's activities, it is expected that such an estimation will result in off-site doses within 20% of the doses that would have been obtained had the missing sample results been available.

The main plant stack, which vents to the atmosphere at a height of 60 meters (197 ft), is considered an elevated release; all other releases are considered ground level (10 m) releases.

Meteorological Data

Wind data collected from the on-site meteorological tower during 1990 were used as input to the dose assessment codes. Data collected at the 60-meter and 10-meter heights were used in combination with elevated and ground level effluent release data, respectively. A more detailed description of the WVDP meteorological monitoring program is given in section 2.1.5.

Applicable Standards

Airborne emissions of radionuclides are regulated by the EPA under the Clean Air Act. Department of Energy facilities are subject to 40 CFR 61, subpart H, "National Emission Standards for Hazardous Air Pollutants (NESHAP) - Radionuclides." The applicable standard for radionuclides released during 1990 is 10 mrem (0.10 mSv) EDE for any member of the public.

Dose Assessment Methodology

AIRDOS-PC (version 3.0) and CAP-88 are the approved versions of the AIRDOS-EPA computer code used to demonstrate compliance with the standard for the 1990 assessment period. Using site-specific meteorological data, AIRDOS-EPA (Moore et al. 1979) calculates the dispersion of radionuclides into the environment following airborne releases and then estimates the external dose to individuals from radionuclides both in the air and deposited on the ground. It also estimates the doses to individuals from inhalation of contaminated air and ingestion of contaminated water and foods produced near the site. The mainframe computer version of AIRDOS-EPA (CAP-88) was also used to estimate the collective dose to the population residing within 80 kilometers of the site.

4.2.1 Maximum Dose to an Off-Site Resident

Based on the airborne radioactivity released from the site during 1990 and using AIRDOS-PC, a person living in the vicinity of the WVDP was estimated to receive an EDE of 7×10^{-4} mrem (7×10^{-6} mSv). This hypothetical maximally exposed individual was assumed to reside continuously about 1.9 kilometers north-northwest of the site and to eat only locally produced foods. As in 1989, approximately 75% of the dose from airborne emission in 1990 was contributed by iodine-129. Cesium-137 and strontium-90 made up much of the remainder, with less than 10% contributed by americium-241 and isotopes of plutonium.

The dose reported above is 0.007% of the 10 mrem (0.10 mSv) standard and can be compared to about one minute of the annual background radiation received by an average member of the U.S. population.

4.2.2 Collective Dose to the Population

The CAP-88 version of AIRDOS-EPA was used to estimate the collective dose to the population. According to census projections for 1990, an estimated 1.7 million people reside within 80 kilometers (50 mi) of the WVDP. This population received an estimated 8×10^{-3} person-rem (8×10^{-5} person-Sv) collective EDE from radioactive airborne effluents released from the WVDP during 1990. The resulting average EDE per individual is 5×10^{-6} mrem (5×10^{-8} mSv).

There are no standards limiting the collective EDE to the population. However, the calculated average individual EDE is 60 million times lower than the 300 mrem (3 mSv) that an average member of the U.S. population receives in one year from natural background radiation (equivalent to an exposure of less than one second of background radiation).

4.3 Estimated Radiological Dose from Liquid Effluents

Sources of Radioactivity from the WVDP

As reported in Chapter 2, four batch releases of liquid radioactive effluents were monitored during 1990. The radioactivity that was discharged in these effluents is listed in Appendix C-1, Table C-1.1.

Applicable Standards

Currently there are no EPA standards establishing limits on the radiation dose to members of the public from liquid effluents except as applied in 40 CFR 141 and 40 CFR 143, Drinking Water Guidelines (USEPA 1984b,c). The potable water wells sampled for radionuclides are upgradient of the West Valley Demonstration Project and are not considered a realistic

pathway in the dose assessment. Since Cattaraugus Creek is not designated as a drinking water supply, the estimated radiation dose was compared with the limits stated in DOE Order 5400.5.

Dose Assessment Methodology

The computer code LADTAP II (Simpson and McGill 1980) was used to calculate the EDE to the maximally exposed off-site individual and the collective EDE to the population from routine releases and dispersion of these effluents. Since the effluents eventually reach Cattaraugus Creek, which is not used as a source of drinking water, the local exposure pathway calculated by the code is from the consumption of 21 kilograms (46 lb) of fish caught in the creek. Population dose estimates assume that the radionuclides are further diluted in Lake Erie before reaching municipal drinking water supplies. A detailed description of LADTAP II is given in "Radiological Parameters for Assessment of WVDP Activities" (WVDP-065).

4.3.1 Maximum Dose to an Off-Site Individual

Based on the radioactivity in liquid effluents released from the WVDP during 1990, an off-site individual was estimated to receive a maximum EDE of 0.23 mrem (2.3×10^{-3} mSv). Approximately 95% of this dose is from cesium-137; the remainder comes from carbon-14. This dose is about 1,300 times lower than the 300 mrem (3 mSv) that an average member of the U.S. population receives in one year from natural background radiation (equivalent to an exposure of seven hours).

4.3.2 Collective Dose to the Population

As a result of radioactivity released in liquid effluents from the WVDP during 1990, the population living within 80 kilometers (50 mi) of the site received a collective EDE of 4.8×10^{-2} person-rem (4.8×10^{-4} person-Sv). This estimate is based on a population of 1.7 million living within the 80-kilometer radius. The resulting average EDE per individual is 2.8×10^{-5} mrem

(2.8×10^{-7} mSv), or approximately ten million times lower than the 300 mrem (3 mSv) that an average person receives in one year from natural background radiation (equivalent to an exposure of less than three seconds).

4.4 Estimated Radiological Dose from All Pathways

The potential dose to the public from both airborne and liquid effluents released from the Project during 1990 is the sum of the individual dose contributions. The maximum EDE from all pathways to a nearby resident was 0.23 mrem (2.3×10^{-3} mSv). This dose is 0.23% of the 100 mrem (1 mSv) annual limit in DOE Order 5400.5. The total collective EDE to the population within 80 kilometers (50 mi) of the site was 5.6×10^{-2} person-rem (5.6×10^{-4} person-Sv), with an average EDE of 3.3×10^{-5} mrem (3.3×10^{-7} mSv) per individual.

Table 4-1 on the following page summarizes the dose contributions from all pathways and compares the individual doses to the applicable standards.

Figure 4-2 shows the trend in dose to the maximally exposed individual over the last five years. The estimated dose for 1990 is higher than the dose reported in 1989 but is within the range of variation observed in previous years. The increase in the dose during 1990 can be attributed mostly to increased cesium-137 releases in liquid effluents and changes in the dose factors applied to these releases.

Figure 4-3 shows the trend in collective dose to the population. The estimated collective dose for 1990 is slightly lower than the dose reported in 1989 but is within the range of variation observed in previous years.

4.5 Estimated Radiological Dose from Local Food Consumption

In addition to dose estimates based on dispersion modeling, the maximum EDE to a nearby resident from consumption of locally produced food can also be estimated. Because the estimated doses using the computer models al-

TABLE 4 - 1

Summary of Dose Assessment from 1990 West Valley Demonstration Project Effluents

	<i>Maximum Dose to an Individual</i> ¹	<i>Maximum Dose to the Population</i> ²
Effective Dose Equivalent from Airborne Emissions ³	7×10^{-4} mrem (7×10^{-6} mSv)	8×10^{-3} person-rem (8×10^{-5} mSv)
EPA Radiation Protection Standard ⁴ (percent of standard)	10 mrem ($7 \times 10^{-3}\%$)	-0-
Effective Dose Equivalent from Liquid Effluents ⁵	2.3×10^{-1} mrem (2.3×10^{-3} mSv)	4.8×10^{-2} person-rem (4.8×10^{-4} person-Sv)
Effective Dose Equivalent from all Releases	2.3×10^{-1}	5.6×10^{-2} person-rem (5.6×10^{-4} person-Sv)
DOE Radiation Protection Standard ⁶ (percent of standard)	100 mrem (0.23%)	-0-
Background Effective Dose Equivalent ⁷ (percent of background)	300 mrem (3 mSv) ($7.8 \times 10^{-2}\%$)	510,000 person-rem (5100 person-Sv) $1.1 \times 10^{-5}\%$

¹ Maximally exposed individual at a residence 1.9 km NNW from the main plant.

² Population of 1.7 million within 80 km of the site.

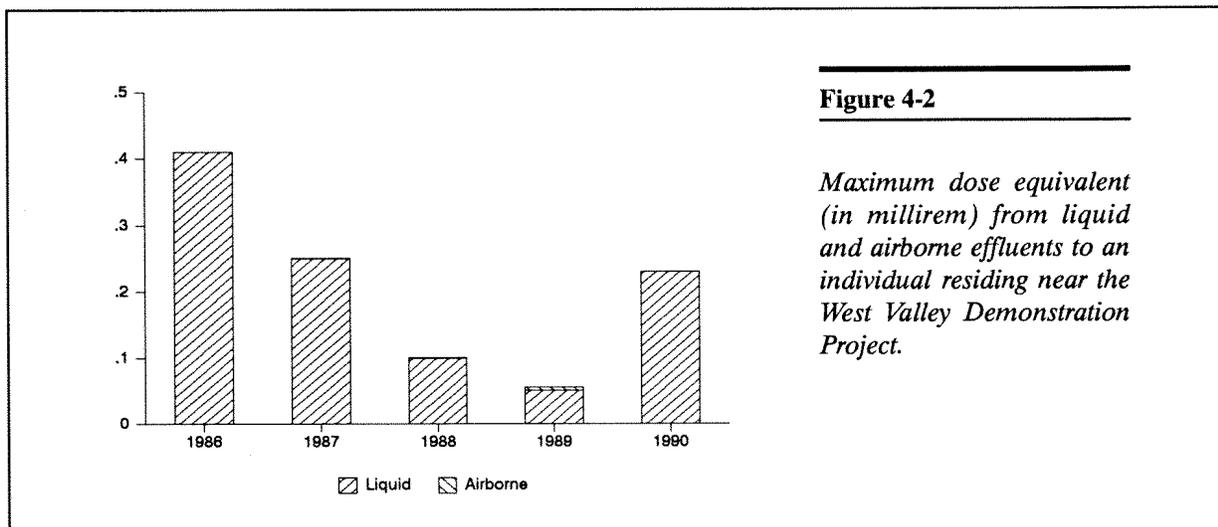
³ Calculated using AIRDOS-EPA (AIRDOS-PC for individual; CAP-88 for population).

⁴ Airborne emissions only.

⁵ Calculated using LADTAP II (effective dose equivalent).

⁶ Applies to doses from both airborne and liquid effluents.

⁷ U.S. average (Source: NCRP 1987).



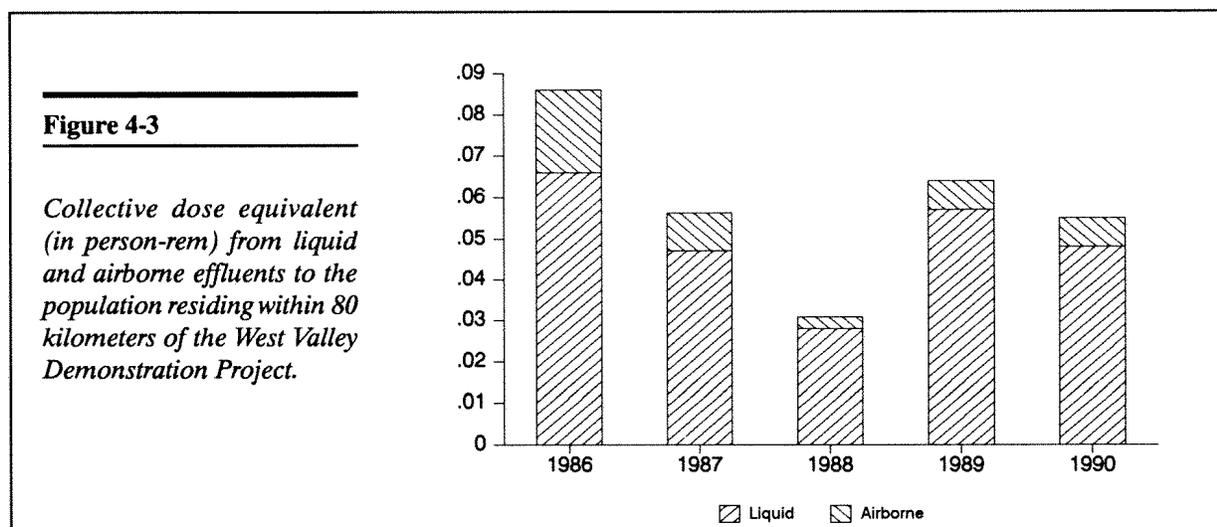
ready incorporate the food pathway, the doses from food consumption should not be added to doses reported in previous sections but should serve as an additional means of measuring the effect of Project operations.

Near-site and control samples of fish, milk, beef, venison, fruit, and vegetables were collected and the samples analyzed for various radionuclides, including tritium, potassium-40, cobalt-60, strontium-90, iodine-129, cesium-134, and cesium-137. The measured radionuclide concentrations are reported in Appendix C-3, Tables C-3.1 through C-3.4.

While the biological samples were collected as scheduled throughout 1990, a number of analyses had not been completed by the contract laboratory in time to be included in the

dose assessment calculated for this year's report. It was not possible, therefore, to make reliable dose assessments regarding the consumption of locally produced foods, except for fish. (See following paragraph). Doses reported in previous sections of this chapter (using computer models) do not differ significantly from the doses reported in previous years' reports. This provides some assurance that dose estimates from food consumption in 1990 will not differ significantly relative to doses reported in previous years.

Based on the net strontium-90 concentration in fish caught below the Springville dam during the first half of 1990, the CEDE to an individual consuming 21 kilograms of fish per year (10.5 kg in the first half of 1990) was estimated to be 1.1E-02 mrem (1.1E-04 mSv).

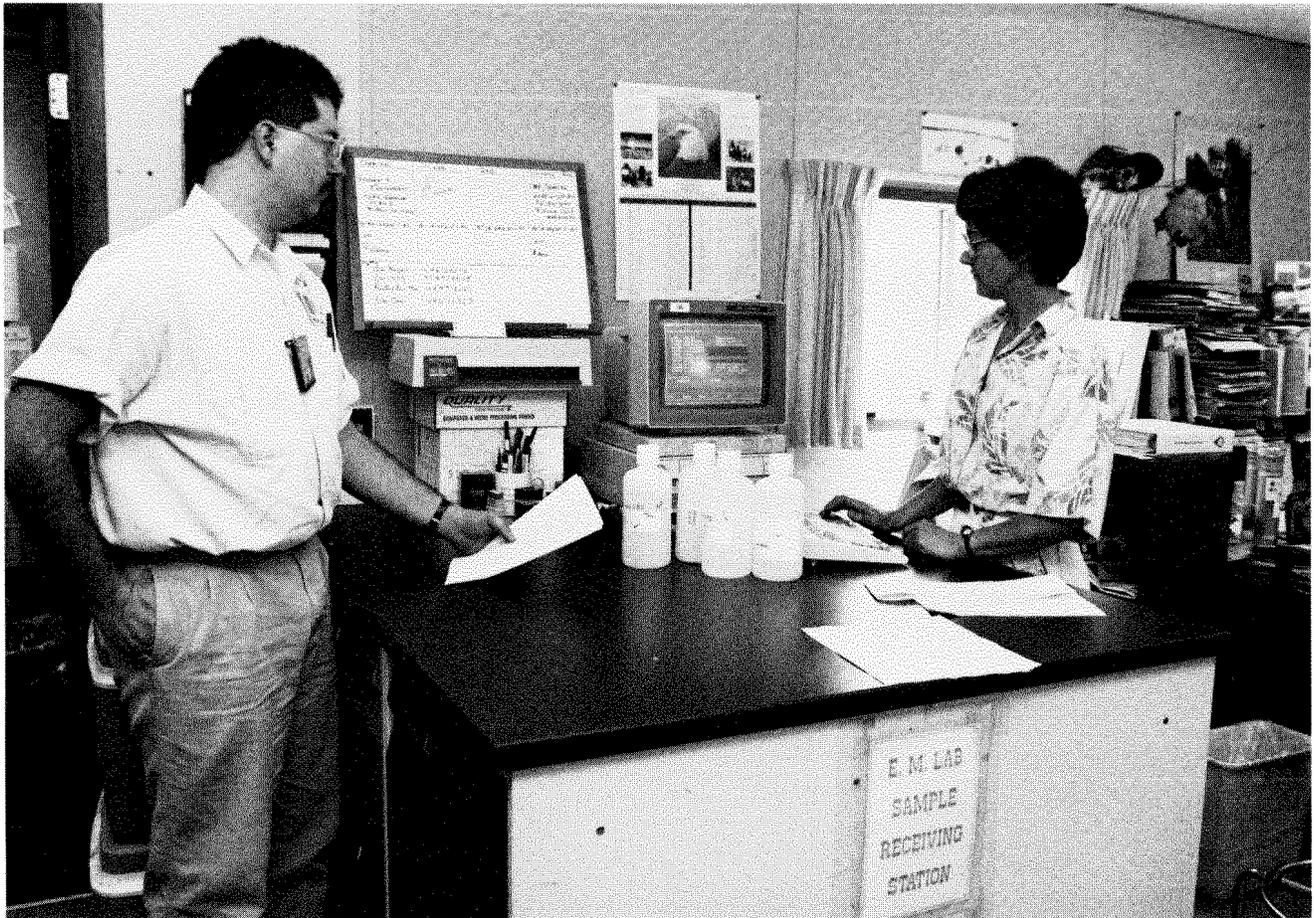


4.0 Radiological Dose Assessment

This is lower than the CEDE calculated for liquid releases (section 4.3.1) by a factor of approximately twenty.

4.6 Conclusions

Based on dose assessment, the West Valley Demonstration Project during 1990 was in compliance with all applicable EPA standards and DOE Orders. The EDE to members of the public estimated from effluent dispersion models and radionuclide concentrations in food samples was below the dose limits, indicating no measurable effects on the public's health.



Computerized Sample Receiving Station in the Environmental Laboratory

5.0 Quality Assurance

The Quality Assurance (QA) program provides for and documents consistency, precision, and accuracy in collecting and analyzing environmental samples and in interpreting and reporting environmental monitoring data.

5.1 Organizational Responsibilities

WVNS has overall responsibility for quality assurance on-site, while Safety and Environmental Assessment (S&EA) is responsible for ensuring the quality of the environmental monitoring program. Environmental Laboratory management and staff are directly responsible for carrying out activities in a manner consistent with good quality assurance practices.

5.2 Program Design

The quality assurance program for environmental monitoring at the WNYNSC is consistent with DOE Order 5700.6B and is based directly upon the eighteen-element program outlined in "Quality Assurance Program Requirements for Nuclear Facilities" (ANSI/ASME NQA-1, 1986), updated under American Society of Mechanical Engineers (ASME) auspices in 1989. These elements are as follows:

- Organization
- Quality Assurance Program
- Design Control
- Procurement Document Control
- Instructions, Procedures, and Drawings
- Document Control

- Control of Purchased Items and Services
- Identification and Control of Items
- Control of Processes
- Inspection
- Test Control
- Control of Measuring and Test Equipment
- Handling, Storage, and Shipping
- Inspection, Test, and Operating Status
- Control of Nonconforming Items
- Corrective Actions
- Quality Assurance Records
- Audits

Any vendors providing analytical services for the environmental monitoring program are contractually required to maintain a quality assurance program consistent with these elements.

5.3 Procedures

Activities affecting the quality of environmental monitoring data are conducted according to approved procedures that clearly describe how the activity should be performed and what precautions are to be taken in connection with the activity. Any person performing an activity affecting the quality of environmental monitoring data must be trained in that procedure and demonstrate proficiency.

New procedures are developed each time a new activity is added to the monitoring program. Procedures are reviewed annually and are updated when necessary. All procedures are controlled so that only current documents are in use.

5.4 Quality Control in the Field

Quality control (QC), an integral component of environmental monitoring quality assurance, is a way of verifying that samples are being collected and analyzed according to established quality assurance procedures; quality control ensures that sample collection and analysis is consistent and repeatable, and it is a means of tracking down and ascertaining possible sources of error. For example, where possible, sample locations are clearly marked in the field to ensure that ensuing samples are collected in the same locations; collection equipment in place in the field is routinely inspected, calibrated, and maintained; and automated sampling stations are kept locked to prevent tampering.

Samples are collected into appropriate containers and labeled immediately with pertinent information. Date, time, person doing the collecting, and special field sampling conditions are recorded and become part of the record for that sample. If necessary, samples are preserved as soon as possible after collection. The scope of the work is indicated by the fact that during 1990 trained Environmental Laboratory personnel collected almost 7,000 samples.

In order to monitor quality problems that might be introduced by the sampling process, field quality control samples are generated that consist of field duplicates, field blanks, trip blanks, and environmental background samples.

■ **Field duplicates:**

Field duplicates are samples collected at the same location at the same time. From that point, they are treated as separate samples. Field duplicates provide a means of assessing the precision of collection methods and are collected at a minimum rate of one per twenty

analyses; more than 1,300 field duplicate analyses were conducted in 1990.

■ **Field blanks:**

A field blank is a sample of laboratory-distilled water that has been introduced into a sample container at a sample collection site in the field and that is processed from that point as a routine sample. Field blanks are used to detect contamination introduced by the sampling procedure. They are processed at a minimum rate of one per twenty analyses.

If the same collection equipment is used for more than one site, a special form of field blank known as an *equipment blank* may be collected by pouring distilled water through collecting equipment and into a sample container. Equipment blanks are collected to detect any cross-contamination that may be passed from one sampling location to another by equipment. Many site wells and surface water collection stations have collecting equipment in place that remains at that location. This equipment is known as "dedicated" equipment, and special equipment blanks are not necessary at these locations.

More than 150 field blank analyses were performed in 1990. No contamination problems were detected.

■ **Trip blanks:**

Trip blanks are prepared by pouring laboratory-distilled water into sample bottles in the laboratory. These bottles are placed into sample coolers and remain there throughout the sampling procedure. Trip blanks are collected only when volatile organics are being monitored in order to detect any volatile organic contamination introduced into the samples from the containers or coolers, or from handling during the collection process or shipping. More than sixty trip blanks were collected in 1990, with no problems of contamination from these sources found.

■ **Environmental background samples:**

The environmental monitoring program includes samples from locations remote from the site for each pathway being monitored for possible radiological contamination. Results from these samples show natural radiological concentrations in samples clearly outside of site influence. These samples serve as backgrounds or "controls," another form of field quality control sample. About 1,000 environmental background sample analyses were conducted in 1990 as part of the environmental monitoring program.

5.5 Quality Control in the Laboratory

Nearly 9,000 samples were processed by the Environmental Laboratory in 1990, including samples collected by laboratory staff and samples submitted to the laboratory by other departments or agencies. More than 60% of these samples were analyzed by the Environmental Laboratory staff, with the rest being sent to other laboratories. Samples not analyzed by the Environmental Laboratory must maintain a level of quality control similar to that maintained by the Environmental Laboratory. Vendor laboratories are required to participate in all relevant crosschecks and to maintain all relevant certifications.

In order to monitor the accuracy and precision of data produced by the Environmental Laboratory, laboratory quality control practices specific to each analytical method are clearly described in approved references or procedures. Laboratory quality control consists of proper training of analysts, maintenance and calibration of measuring equipment and instrumentation, and specific methods of processing samples as a means of monitoring laboratory performance.

Analytical instruments and counting systems are calibrated at specified frequencies and logs of instrument calibration and maintenance are kept. Calibration methods for each instrument are specified in procedures or in manufacturers' directions. Standards traceable to the National Institute of Standards and

Technology (NIST) are used to calibrate counting and source instrumentation.

Laboratory quality control samples consist of three general types: standards (including spikes), used to assess accuracy; blanks, to assess the possibility of contamination; and duplicates, to assess precision. Crosschecks also are performed.

■ **Standards:**

Laboratory standards consist of materials containing a known concentration of the analyte of interest, such as a pH buffer or a Pu-239 counting standard. These may consist of NIST-traceable standards or standard reference materials (SRMs) from other sources. At a minimum, one reference standard is analyzed for each ten sample analyses, or one per day, to determine if the method is producing results within acceptable limits.

The results of standard analyses are plotted on control charts that specify acceptable limits. If results are outside the control limits, the system must be brought back into control before sample analysis can resume.

Another form of standard analysis is a laboratory spike, in which a known amount of analyte is added to a sample or blank before the sample is analyzed. The percent recovery of the analyte is an indication of how much of the analyte of interest is being detected in the analysis of actual samples; hence, a spike is an assessment of the accuracy of the method. Acceptability limits are also documented for spike recovery.

Control charts are kept and are routinely monitored. To supplement the routine analysis of standards, EPA quality control samples of known concentrations are submitted to analysts in the laboratory by the S&EA quality assurance staff. The concentrations of the samples are unknown to the analyst and serve as an additional performance check on the accuracy of Environmental Laboratory analyses. More than 400 laboratory standard analyses (including spikes) were performed in 1990.

■ **Laboratory blanks:**

Laboratory blanks are prepared from a matrix similar to that of the sample but known to contain none of the analyte of interest. For instance, distilled water, taken through the same preparatory procedure as a sample, serves as a laboratory blank for both radiological and chemical water analyses. Positive results for an analyte in a blank indicate that something was wrong with the analysis and corrective action should be taken. One blank is routinely processed daily or with each "run" of samples. S&EA quality control provided blank samples as additional checks on the prevention of cross-contamination in the analytical process in the Environmental Laboratory.

A special form of laboratory blank for radiological samples is an instrument background count, which is a count taken of a planchette or vial containing no sample. The count serves two purposes: 1) to determine if contamination is present in the counting instrument; and 2) to determine the background correction that should be applied in calculations of radiological activity. A background count is performed before each day's counting.

■ **Laboratory Duplicates:**

Duplicates are analyzed to assess precision in the analytical process. Laboratory duplicates are created by splitting existing samples before analysis; each split is treated as a separate sample. If the analytical process is in control, results for each split should be within documented criteria of acceptability. Approximately 700 laboratory duplicate analyses were performed in 1990. As with standards, duplicate samples were submitted to the Environmental Laboratory by S&EA quality assurance as an additional performance check on laboratory precision.

■ **Crosschecks:**

The Environmental Laboratory participates in formal radiological crosscheck programs conducted by the Department of Energy

Radiological and Environmental Science Laboratory (RESL), the Environmental Monitoring Systems Laboratory of the USEPA (EMSL), Las Vegas, and the Environmental Measurements Laboratory (EML), New York City. Crosscheck performance is summarized in Appendix D.

In addition to radiological crosschecks, the Environmental Laboratory, in conjunction with the on-site Analytical and Process Chemistry Laboratories, maintains certification by the New York State Department of Health (NYSDOH) for various non-radiological analytes. To maintain this certification, the laboratory participates in semiannual crosschecks for the analytes certified by NYSDOH.

5.6 Personnel Training

Anyone performing environmental monitoring program activities must be trained in the appropriate procedures and qualified accordingly before carrying out the procedure as part of the site environmental monitoring program. Requalifications are conducted periodically.

5.7 Record Keeping

Control of records is an integral part of the environmental monitoring program. Field data sheets, chain-of-custody forms, analytical requests, sample-shipping documents, sample logs, bench logs, laboratory data sheets, equipment maintenance logs, calibration logs, training records, crosscheck performance records, and weather measurements, in addition to other records, are all maintained as documentation of the environmental monitoring program. All records pertaining to the program are also reviewed routinely and securely stored.

In late 1990 new computer software, the Laboratory Information Management System (LIMS), was installed in the Environmental Laboratory. Although installed too late for use in 1990, this system will be integrated into the laboratory record-keeping system and will be used for sample logging, auto-logging of samples, printing labels for samples, data

storage and processing, monitoring of quality control samples, sample tracking, producing sampling and analytical worklists, and generating reports. This new system will decrease much of the paperwork involved in the environmental monitoring program.

5.8 Chain-of-custody Procedures

Field data sheets, which are filled out when samples are collected, serve as chain-of-custody records for the samples. Samples are brought in from the field and logged at the sample receiving station, after which they are stored in a sample lock-up before analysis or shipping.

Samples sent to other laboratories for analysis are accompanied by a chain-of-custody/analytical request form. Signature control must be maintained by the agent transporting the samples. Vendor laboratories are required to maintain internal chain-of-custody records and to store the samples under secure conditions.

5.9 Audits

Routine internal appraisals of the Safety & Environmental Assessment Department and the Environmental Laboratory are conducted by site quality assurance personnel, who also audit the environmental monitoring programs. In addition, agencies external to the WVDP audit the program as a whole.

5.10 Performance Reporting

The performance of the laboratory in crosscheck programs is published in the summary of results for each crosscheck. The Environmental Laboratory results are compared with the true value for the samples and the Environmental Laboratory performance is compared with those of other laboratories participating in the crosscheck.

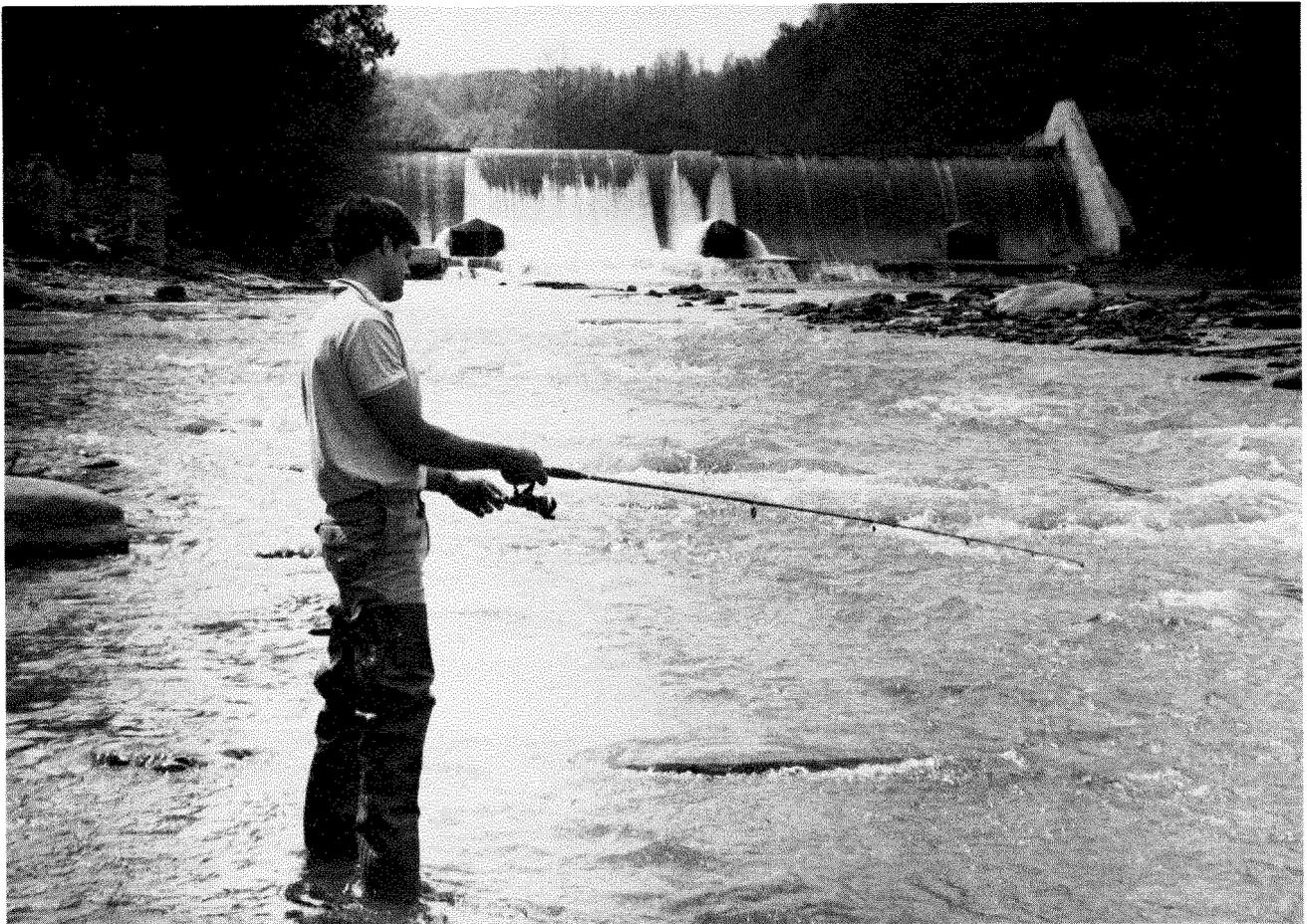
Quarterly summaries of quality control performance may be included in the appropriate monthly trend analysis reports.

Monthly trend analysis reports document possible warning levels or trends picked up as part of the environmental monitoring program. Monthly SPDES discharge reports are generated and submitted to the New York State Department of Environmental Conservation (NYSDEC).

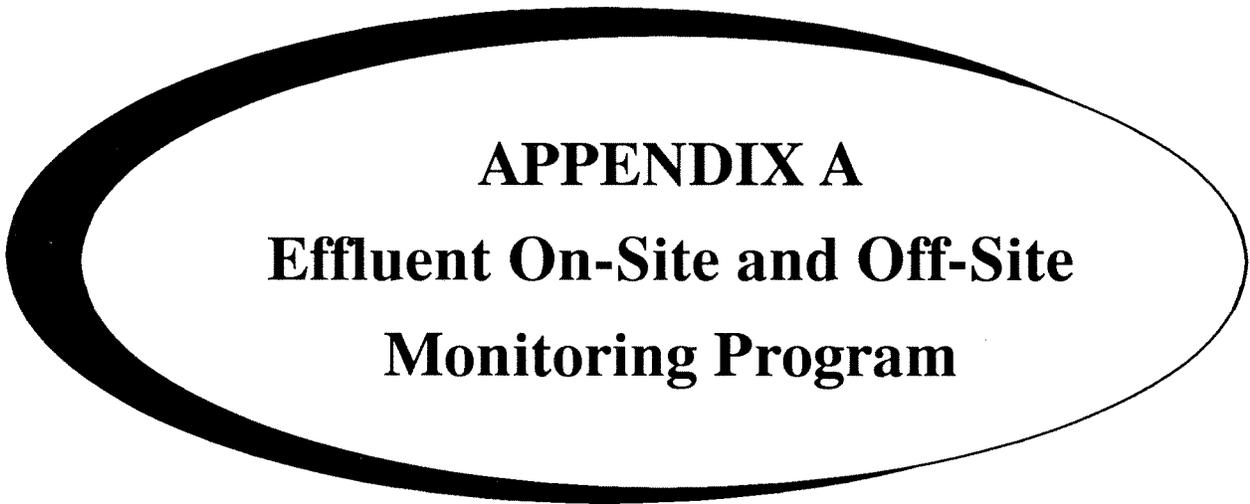
5.11 Independent Data Verification

All Environmental Laboratory analytical data is reviewed and approved by a qualified person other than the person conducting the analysis. As part of the verification procedure, quality control samples analyzed in conjunction with the samples are examined and calculations are checked before approval. S&EA quality assurance personnel also conduct checks of the data in addition to the initial, routine reviews. All software used to generate data is subjected to a verification procedure before being used.

Data must be formally approved before being reported or used in the calculation of environmental monitoring data. Reports generated from data are subjected to a peer review process before being issued.



Environmental Sampling —An Art As Well As A Science



APPENDIX A
Effluent On-Site and Off-Site
Monitoring Program

1990 Effluent On-Site and Off-Site Monitoring Program

The following schedule represents the West Valley Demonstration Project's routine environmental monitoring program for 1990. This schedule meets or exceeds the minimum program needed to satisfy the requirements of DOE Order 5400.1, which superseded DOE 5484.1A, Chapter III, in late 1988. It also meets requirements of DOE Order 5400.5 and draft DOE Order 5400.6. Specific methods and recommended monitoring program elements are found in DOE/EP-0096, EFFLUENT MONITORING, and DOE/EP-0023, ENVIRONMENTAL SURVEILLANCE, which are the bases for selecting most of the schedule specifics. Additional monitoring is mandated by Operational Safety Requirements (OSRs) and air and water discharge permits (40 CFR 61 and SPDES), which also require a formal report. These specific cases are identified in the schedule under MONITORING/REPORTING REQUIREMENTS. The overall environmental program schedule is based on OSR-GP-4.

Schedule Of Environmental Sampling

The following table is a schedule of environmental sampling at the West Valley Demonstration Project. Locations of the sampling points are shown in Figures A-1 through A-9. The index below is a list of the codes for various sample locations. Table headings in the schedule are as follows:

- **Sample Location Code.** The physical location where the sample is collected is described. The code consists of seven characters: The first character identifies the sample medium as Air, Water, Soil/Sediment, Biological, or Direct Measurement. The second character specifies on-site or off-site. The remaining characters describe the specific location (e.g., AFGRVAL is Air Off-site at Great Valley).
- **Monitoring/Reporting Requirements.** The reports generated from sample data and the basis for monitoring that location and any additional references to permits or OSRs are noted.
- **Sampling Type/Medium.** This describes the collection method and the physical characteristics of the medium.
- **Collection Frequency.** Indicates how often the samples are collected or retrieved.
- **Total Annual Samples.** The number of discrete physical samples collected annually, not including composites of collected samples.
- **Analyses Performed/Composite Frequency.** The individual analyses of the samples or composites of samples and the frequency of analyses is described.

SUMMARY OF MONITORING PROGRAM CHANGES IMPLEMENTED IN 1990

WNSP001. Analytes added to routine site sampling: To routine discharge grab samples added dichlorodifluoromethane, trichlorofluoromethane, 3,3-dichlorobenzidine, tributyl phosphate, and vanadium. To semianual grab sample added bis(2-ethylhexyl) phthalate and 4-dodecene.

WNSTPBS. New sample location/type added: Sampling of sanitary waste sludge for alpha/beta, H-3.

WNSW74A. Existing site upgraded: Automated sampling put on line in 1990. In 1989 site was grab-sampled monthly and analyzed for gross alpha/beta, H-3, and pH. In 1990 a composite was sampled weekly for gross alpha/beta, H-3, pH and conductivity, a monthly composite was analyzed for gamma isotopic and Sr-90, and a quarterly composite was analyzed for C-14, I-129, Pu/U isotopic and Am-241.

WN8D1DR. New sampling location added: Added weekly sampling of the high-level waste tank farm underdrain for gross alpha/beta, H-3, pH, and a monthly composite for gamma isotopic and Sr-90.

WNDRNKW. 1989 point WNDRNKW (site drinking water) was replaced by four new points monitoring drinking water in the Environmental Laboratory (WNDNKEL), maintenance shop (WNDNKMS), storage tank (WNDNKUR), and main plant (WNDNKMP).

ANRGFOP. New fallout pot added at rain gage by meteorological tower on-site.

SFRSPRD.
SFBOEHN. U- isotopic analysis added at these three soil collection sites.
SFGRVAL.

BFB - Tritium analysis added to all beef and deer samples.

BFD -

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* Not detailed on map

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* Not detailed on map

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1990 EFFLUENT AND ON-SITE MONITORING PROGRAM

<u>SAMPLE LOCATION CODE</u>	<u>MONITORING/REPORTING REQUIREMENTS</u>	<u>SAMPLING TYPE/MEDIUM</u>	<u>COLLECTION FREQUENCY</u>	<u>TOTAL ANNUAL SAMPLES</u>	<u>ANALYSES PERFORMED/ COMPOSITE FREQUENCY</u>
Main Plant Ventilation Exhaust Stack ANSTACK	Airborne radioactive effluent point including LWTS and Vitrification Off-Gas	Continuous off-line air particulate monitor	Continuous measurement of fixed filter, replaced weekly	N/A	Real time alpha and beta monitoring
Supernatant Treatment System (STS) Ventilation Exhaust ANSTSTK	<u>Required by:</u> OSR-GP-1 40 CFR 61	Continuous off-line air particulate filter	Weekly	104 (52 per location)	Gross alpha/beta, gamma isotopic.* Quarterly composite for Sr-90, Pu/U isotopic, Am-241, gamma isotopic
	<u>Reported:</u> Monthly Environmental Monitoring Trend Analysis	Continuous off-line desiccant column for water vapor collection	Weekly	104 (52 per location)	H-3
	Annual Effluent and On-Site Discharge Report	Continuous off-line charcoal cartridge	Weekly	104 (52 composited to 4 per location)	Quarterly composite for I-129
	Annual Environmental Monitoring Report Air Emission Annual Report (NESHAP)				

*Weekly gamma isotopic only if gross activity rises significantly.

SAMPLING RATIONALE

ANSTACK Draft DOE 5400.6, III.1; OSR-GP-1, 1.A, 2.B; and DOE/EP-0096, 3.3.
Monitors and samples HEPA-filtered ventilation from most process areas, including cell ventilation, vessel off gas, FRS and head end ventilation, analytical area.

ANSTSTK Draft DOE 5400.6, III.1; OSR-GP-1, 1.B, 2.B; and DOE/EP-0096, 3.3.
Monitors and samples HEPA-filtered ventilation from building areas involved in treatment of high-level waste supernatant.

1990 EFFLUENT AND ON-SITE MONITORING PROGRAM

<u>SAMPLE LOCATION CODE</u>	<u>MONITORING/REPORTING REQUIREMENTS</u>	<u>SAMPLING TYPE/MEDIUM</u>	<u>COLLECTION FREQUENCY</u>	<u>TOTAL ANNUAL SAMPLES</u>	<u>ANALYSES PERFORMED/ COMPOSITE FREQUENCY</u>
Cement Solidification System (CSS) Ventilation Exhaust ANCSSTK	Airborne radioactive effluent point <u>Required by:</u> OSR-GP-1 40 CFR 61	Continuous off-line air particulate monitor	Continuous measurement of fixed filter, replaced weekly	N/A	Real-time alpha and beta monitoring
Contact Size Reduction Facility Exhaust ANCSRFK	<u>Reported:</u> Monthly Environmental Monitoring Trend Analysis Annual Effluent and On-site Discharge Report Annual Environmental Monitoring Report Air Emissions Annual Report (NESHAP)	Continuous off-line air particulate filter	Weekly	104 (52 per location)	Gross alpha/beta, gamma isotopic.* Quarterly composite for Sr-90, Pu/U isotopic, Am-241, gamma isotopic.
		Continuous off-line charcoal cartridge.	Weekly	104 (52 composited to 4 per location)	Quarterly composite for I-129

*Weekly gamma isotopic only if gross activity rises significantly.

SAMPLING RATIONALE

- ANCSSTK Draft DOE 5400.6, III.1; OSR-GP-1, 1.B, 2.B; AND DOE/EP-0096, 3.3.
Monitors and samples HEPA-filtered ventilation from process areas and cell used for decontaminated high-level radioactive supernatant solidification with cement.
- ANCSRFK Draft DOE 5400.6, III.1; OSR-GP-1, 1.B, 2.B; and DOE/EP-0096, 3.3.
Monitors and samples HEPA-filtered ventilation from process area where radioactive tanks, pipes, and other equipment are reduced in volume by cutting with a plasma torch.

1990 EFFLUENT AND ON-SITE MONITORING PROGRAM

<u>SAMPLE LOCATION CODE</u>	<u>MONITORING/REPORTING REQUIREMENTS</u>	<u>SAMPLING TYPE/MEDIUM</u>	<u>COLLECTION FREQUENCY</u>	<u>TOTAL ANNUAL SAMPLES</u>	<u>ANALYSES PERFORMED/ COMPOSITE FREQUENCY</u>
Supercompactor Exhaust ANSUPCV	Airborne radioactive effluent point	Continuous off-line air particulate monitor during operation	Continuous measurement of fixed filter, collected and replaced every seven operating days, or at least monthly when unit is operated	N/A	Real time beta monitoring
	<u>Required by:</u> OSR-GP-1 40 CFR 61 <u>Reported:</u> Monthly Environmental Monitoring Trend Analysis Annual Effluent and On-site Discharge Report Annual Environmental Monitoring Report Air Emissions Annual Report (NESHAP)	Continuous off- line air particulate filter. (maximum of 26 operating weeks expected)		26 composited to 4	Filters for gross alpha/beta, gamma isotopic* upon collection Quarterly composites: filters for Sr-90, Pu/U isotopic, Am-241, gamma isotopic

* Weekly gamma isotopic only if gross activity rises significantly.

SAMPLING RATIONALE

ANSUPCV

Draft DOE 5400.6, III.1; OSR-GP-1, 1.B, 2.B; and DOE/EP-0096, 3.3.

Monitors and samples HEPA-filtered ventilation from area where low-level radioactive waste volume is reduced by compaction.

1990 EFFLUENT AND ON-SITE MONITORING PROGRAM

<u>SAMPLE LOCATION CODE</u>	<u>MONITORING/REPORTING REQUIREMENTS</u>	<u>SAMPLING TYPE/MEDIUM</u>	<u>COLLECTION FREQUENCY</u>	<u>TOTAL ANNUAL SAMPLES</u>	<u>ANALYSES PERFORMED/ COMPOSITE FREQUENCY</u>
Lagoon 3 Discharge Weir WNSP001	Primary point of liquid effluent batch release	Grab liquid	Daily, during Lagoon 3 discharge	40-80	Daily: gross beta, conductivity, pH, flow. Every sixth daily sample: gross alpha/beta, H-3, Sr-90, gamma isotopic. Weighted monthly composite of daily samples: gross alpha/beta, H-3, C-14, Sr-90, I-129, gamma isotopic, Pu/U isotopic, Am-241
	<u>Required by:</u> OSR-GP-2 SPDES Permit				
	<u>Reported:</u> Monthly SPDES DMR				
	Annual Effluent and On-site Discharge Report	Composite liquid	Twice during discharge, near start, and near end	8-10	Two 24-hour composites for Al, NH ₃ , As, BOD-5, Fe, Zn, pH, suspended solids; SO ₄ , NO ₃ , NO ₂ , Cr ⁺⁶ , Cd, Cu, Pb, Ni
	Annual Environmental Monitoring Report	Grab liquid	Twice during discharge, same as composite	8-10	Settleable solids, pH, cyanide amenable to chlorination, oil and grease, Dichlorodifluoromethane, Trichlorofluoromethane, 3,3-Dichlorobenzidine, Tributylphosphate, Vanadium
		Composite liquid	Annually	1	Annually, a 24-hour composite for: Cr, Se, Ba, Sb
		Grab liquid	Annually	1	Chloroform
	Grab liquid	Semiannually	2	Bis(2-Ethylhexyl) Phthalate, 4-Dodecene	

SAMPLING RATIONALE

WNSP001

DOE 5400.5 and Draft DOE 5400.6, II.4.c.(1).

By regulation, all liquid effluent streams from DOE facilities shall be evaluated and their potential for release of radionuclides addressed.

New York State SPDES permit No. NY0000973.

These regulations are met for radiological parameters by daily grab sampling during periods of Lagoon 3 discharge. Sampling for chemical constituents is performed near the beginning and end of discharge periods to meet the site SPDES permit. Both grab samples and 24-hour composite samples are collected.

1990 EFFLUENT AND ON-SITE MONITORING PROGRAM

<u>SAMPLE LOCATION CODE</u>	<u>MONITORING/REPORTING REQUIREMENTS</u>	<u>SAMPLING TYPE/MEDIUM</u>	<u>COLLECTION FREQUENCY</u>	<u>TOTAL ANNUAL SAMPLES</u>	<u>ANALYSES PERFORMED/ COMPOSITE FREQUENCY</u>
Frank's Creek at Security Fence WNSP006	Combined facility liquid discharge <u>Required by:</u> OSR-GP-2 <u>Reported:</u> Monthly Environmental Monitoring Trend Analysis Annual Environmental Monitoring Report	Timed continuous composite liquid	*Weekly	52	Gross alpha/beta, H-3, pH, conductivity. Monthly composite: gamma isotopic and Sr-90. Quarterly composite: C-14, I-129, Pu/U isotopic, Am-241.
Sanitary Waste Discharge WNSP007	Liquid effluent point for sanitary and utility plant combined discharge <u>Required by:</u> SPDES Permit <u>Reported:</u> Monthly SPDES DMR Monthly Environmental Monitoring Trend Analysis Annual Effluent and On-site Discharge Report Annual Environmental Monitoring Report	24 hour composite liquid Grab liquid Grab liquid	3/month Weekly Annually	36 52 1	Gross alpha/beta, H-3, suspended solids, NH ₃ , BOD-5, Fe pH, settleable solids Chloroform
Sanitary Waste Sludge WNSTPBS	Operational STP Monitoring	Grab sludge	On demand (at least monthly)	12	Alpha/beta, H-3

*Samples collected simultaneously for NYSDOH.

SAMPLING RATIONALE

WNSP006 Draft DOE 5400.6, V.11.a.(1).(d).
 See WNSP001 for radiological rationale.

WNSP007 Draft DOE 5400.6, II.4.c.(1).
 Sampling rationale is based on New York State SPDES permit No. NY0000973 and DOE 5400.5 criteria for discharge of radioactivity to and from the sewage treatment plant.

WNSTPBS DOE 5400.5.
 Composite of STP surge tank, sludge holding tank, and clarifier sludge analyzed for operational screening.

1990 EFFLUENT AND ON-SITE MONITORING PROGRAM

<u>SAMPLE LOCATION CODE</u>	<u>MONITORING/REPORTING REQUIREMENTS</u>	<u>SAMPLING TYPE/MEDIUM</u>	<u>COLLECTION FREQUENCY</u>	<u>TOTAL ANNUAL SAMPLES</u>	<u>ANALYSES PERFORMED/ COMPOSITE FREQUENCY</u>
N.E. Swamp Drainage WNSWAMP*	Site surface drainage	Grab liquid	Monthly	12	Gross alpha/beta, H-3, pH
North Swamp Drainage WNSW74A	<u>Reported:</u> Annual Effluent and On-site Discharge Report	Timed continuous composite liquid	Weekly	52	Gross alpha/beta, H-3, pH, conductivity Monthly composite: gamma isotopic, Sr-90. Quarterly composite: C-14, I-129, Pu/U isotopic, Am-241
High-level waste farm underdrain WN8D1DR	Drains subsurface water from HLW storage tank area. <u>Reported:</u> Monthly Environmental Monitoring Trend Analysis	Grab liquid	Weekly	52	Gross alpha/beta, H-3, pH. Monthly composite: gamma isotopic, Sr-90.
French Drain WNSP008	Drains subsurface water from LLWT Lagoon area <u>Required by:</u> SPDES Permit <u>Reported:</u> Monthly SPDES DMR Annual Effluent and On-Site Discharge Report Annual Environmental Monitoring Report	Grab liquid	3/month Monthly Annually	36 12 1	pH, conductivity, BOD-5, Fe Gross alpha/beta, H-3 Ag, Zn

*Samples collected simultaneously for NYSDOH.

SAMPLING RATIONALE

WNSWAMP Draft DOE 5400.6, V.11.a.(1).(b).

NE site surface water drainage; provides for the sampling of this discrete drainage path for uncontrolled surface waters just before they leave the site's controlled boundary. Waters collected represent surface and subsurface drainages from the construction and demolition debris landfill (CDDL), old hardstand areas and other possible north plateau sources of radiological or nonradiological contamination.

WNSW74A Draft DOE 5400.6, V.11.a.(1).(b).

N site surface water drainage; provides for the sampling of this discrete drainage path for uncontrolled surface waters just before they leave the site's controlled boundary. Waters collected represent surface and subsurface drainages from Lag Storage areas and other possible north plateau sources of radiological or nonradiological contamination.

WN8D1DR Draft DOE 5400.6, V.11.a.(3).(a).

Monitors the potential influence on subsurface drainage surrounding the high-level waste tank farm.

WNSP008 Draft DOE 5400.6, II.4.c.(1).

French drain of subsurface water from lagoon (LLWTF) area. NYSDEC SPDES permit also provides for the sampling of this discrete drainage path for uncontrolled subsurface waters before they flow into Erdman Brook. Waters collected represent subsurface drainages from downward infiltration around the LLWTF and lagoon systems. This point would also monitor any subsurface spillover from the overflowing of Lagoons 2 and 3. Sampling of significance for both radiological and nonradiological contamination.

1990 EFFLUENT AND ON-SITE MONITORING PROGRAM

<u>SAMPLE LOCATION CODE</u>	<u>MONITORING/REPORTING REQUIREMENTS</u>	<u>SAMPLING TYPE/MEDIUM</u>	<u>COLLECTION FREQUENCY</u>	<u>TOTAL ANNUAL SAMPLES</u>	<u>ANALYSES PERFORMED/ COMPOSITE FREQUENCY</u>
Facility Yard Drainage WNSP005	Combined drainage from facility yard area <u>Reported:</u> Internal Review	Grab liquid	Monthly	12	Gross alpha/beta, H-3, pH
Cooling Tower Basin WNCOLW	Cools plant utility steam system water <u>Reported:</u> Internal Review	Grab liquid	Monthly	12	Gross alpha/beta, H-3, pH
WNDNK Series Site Potable Water	Source of water within site perimeter	Grab Liquid	Monthly	48 (12 per location)	Gross alpha/beta, H-3, pH
Environmental Lab Drinking Water WNDNKEL	<u>Reported:</u> Internal Review		Annually*	2	Toxic metals, pesticides, chemical pollutants
Maintenance Shop Drinking Water WNDNKMS					
Potable Water Storage Tank (UR) WNDNKUR					
Main Plant Drinking Water WNDNKMP					
SDA Holding Lagoon WNSP003	State Disposal Area Holding Lagoon <u>Reported:</u> Annual Environmental Monitoring Report NYSERDA	Grab liquid	Annually (as required)	1	Gross alpha/beta, H-3, C-14, pH, gamma isotopic, Sr-90, I-129, Pu/U isotopic

*WNDNKEL and WNDKUR only.

SAMPLING RATIONALE

WNSP005	<p>Facility yard surface water drainage; generally in accordance with draft DOE 5400.6, V.11.a.(1).(b). Formerly, in accordance with NYSDEC SPDES permit No. NY0000973.</p> <p>Provides for the sampling of this discrete drainage path for uncontrolled surface waters just after outfall 007 discharge into the drainage and before they flow to Erdman Brook. Waters collected represent surface and subsurface drainages primarily from the main plant yard area. Historically this point was used to monitor sludge pond(s) and utility room discharges to the drainage. These two sources have been rerouted. Migration of residual site contamination around the main plant dictates surveillance of this point for radiological parameters primarily.</p>
WNC00LW	<p>Facility cooling tower circulation water; generally in accordance with draft DOE 5400.6, V.11.a.(1).(b).</p> <p>Operational sampling carried out to confirm no migration of radiological contamination into the primary coolant loop of the HLWTF and/or plant utility steam systems. Migration from either source might indicate radiological control failure. Process knowledge indicates that radiological monitoring is of primary significance.</p>
WNDNKEL	<p>Site drinking water; generally according to draft DOE 5400.6, V.11.a.(2).</p> <p>Potable water sampling carried out to confirm no migration of radiological and/or nonradiological contamination into the site's drinking water supply. Sampled at the Environmental Laboratory in order to monitor the point farthest away from the point of potable water generation.</p>
WNDNKMS	<p>Site drinking water; generally in accordance with draft DOE 5400.6, V.11.a.(2).</p> <p>Same rationale as WNDNKEL but sampled at the maintenance shop in order to monitor a point that is at an intermediate distance from the point of potable water generation and that is used heavily by site personnel.</p>
WNDNKUR	<p>Site drinking water; generally in accordance with draft DOE 5400.6, V.11.a.(2).</p> <p>Same rationale as WNDNKEL but sampled at the Utility Room so as to monitor the point closest to the point of potable water generation.</p>
WNDNKMP	<p>Site drinking water; generally in accordance with draft DOE 5400.6, V.11.a.(2).</p> <p>Same rationale as WNDNKMS but sampled at the main plant water fountain. (Site was previously coded as WDNKLR).</p>
WNSP003	<p>SDA effluent and area surface water holding lagoon; generally in accordance with draft DOE 5400.6, II.4.c.(1). Formerly, in accordance with NYSDEC SPDES permit No. NY0000973.</p> <p>Operational sampling carried out to characterize waters contained within SDA holding lagoon. Characterization for radiological constituents only as per agreement with NYSERDA.</p>

1990 EFFLUENT AND ON-SITE MONITORING PROGRAM

<u>SAMPLE LOCATION CODE</u>	<u>MONITORING/REPORTING REQUIREMENTS</u>	<u>SAMPLING TYPE/MEDIUM</u>	<u>COLLECTION FREQUENCY</u>	<u>TOTAL ANNUAL SAMPLES</u>	<u>ANALYSES PERFORMED/ COMPOSITE FREQUENCY</u>
Frank's Creek E of SDA WNFRC67	Drains NYS Low-Level Waste Disposal Area <u>Reported:</u> Internal review NYSERDA	Grab liquid	*Monthly	12	Gross alpha/beta, H-3, pH
Erdman Brook N of Disposal Areas WNERB53	Drains NYS and WVDP disposal areas <u>Reported:</u> Internal review NYSERDA	Grab liquid	Weekly *Monthly	52	Gross alpha/beta, H-3, pH
Ditch N of WVDP NDA & SDA WNNDADR	Drains WVDP disposal and storage area <u>Reported:</u> Internal review Environmental Monitoring Trend Analysis	Timed continuous composite liquid	Weekly	52	pH Monthly composite: gross alpha/beta, gamma isotopic, H-3. Quarterly composite: Sr-90, I-129
Drainage S of Drum Cell WNDCELD	<u>Reported:</u> Internal review	Grab liquid	Weekly	52	pH Monthly composite: gross alpha/beta, gamma isotopic, H-3. Quarterly composite: Sr-90, I-129

*Samples collected simultaneously for NYSDOH.

SAMPLING RATIONALE

WNFRC67 Draft DOE 5400.6, V.11.a.(1).(a).

Monitoring the potential influence of both the New York State low-level waste disposal area (SDA) and drum cell drainage into Frank's Creek east of the SDA and upstream of the confluence with Erdman Brook.

WNERB53 Draft DOE 5400.6, V.11.a.(1).(a).

Monitors the potential influence of the drainages from the SDA and the WVDP disposal area into Erdman Brook upstream of the confluence with Frank's Creek.

WNNDADR Draft DOE 5400.6, V.11.a.(1).(a).

Monitors the potential influence of the WVDP storage and disposal area drainage into Lagoon Road Creek upstream from confluence with Erdman Brook.

WNDCELD Draft DOE 5400.6, V.11.a.(1).(a).

Monitors potential influence of drum cell drainage into Frank's Creek south of the SDA and upstream of WNFRC67.

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On-site Standing Water (ponds not receiving effluent) WNSTAW Series	Water within vicinity of plant airborne or ground-water effluent <u>Reported:</u> Internal Review	Grab liquid	Annually	7-10*	Gross alpha/beta, H-3, pH, conductivity, chloride, Fe, Mn, Na, phenols, sulfate
Test Pit N of HLW Area WNSTAW1					
Slough SW of RTS Drum Cell WNSTAW2					
Pond SE of Heinz Road WNSTAW3					
Border Pond SW of AFRT240 WNSTAW4					
Border Pond SW of DFTLD13 WNSTAW5					
Borrow Pit NE of Project Facilities WNSTAW6					
Pond SW of Project Facilities W of Rock Springs Road WNSTAW7					
Slough N of Quarry Creek WNSTAW8					
North Reservoir Near Intake WNSTAW9					
Background Pond at Sprague Brook Maintenance Building WNSTAWB					

*Number of points sampled depends upon on-site ponding conditions during the year.

SAMPLING RATIONALE

WNSTAW Series	Draft DOE 5400.6, V.11.a.(1).(b). Monitoring of on- and off-site standing waters at locations listed below. Although none receive effluent directly, the potential for contamination is present except at the background location.
WNSTAW1	Test pit area located north of the main plant and high-level waste storage. Location is within the inner security fence in an area of high vehicular traffic and construction. Does not appear to be drained off-site via known pathways. Periodically goes dry.
WNSTAW2	Slough southwest of RTS drum cell. Standing water close to drum cell storage area.
WNSTAW3	Pond southeast of Heinz Road.
WNSTAW4	Border pond located south of AFRT240. Chosen to be a location for obtaining high potential concentration based on meteorological data. Perimeter location adjacent to a working farm. Drainage extends through private property and is accessible to public.
WNSTAW5	Border pond located west of Project facilities near the perimeter fence and DFTLD13. Chosen to be a location for obtaining high potential concentration based on meteorological data. Location is adjacent to private residence and potentially accessible by the general public.
WNSTAW6	Borrow pit northeast of Project facilities just outside of inner security fence. Considered to be the closest standing water to the main plant and high-level waste facilities (in lieu of the availability of WNSTAW1).
WNSTAW7	Pond southwest of Project facilities west of Rock Springs Road.
WNSTAW8	Slough north of Quarry Creek.
WNSTAW9	North reservoir near intake. Chosen to provide data in the event of potentially contaminated site potable water supply. Location is south of main plant facilities.
WNSTAWB	Pond located near the Sprague Brook maintenance building. Considered a background location approximately 14 km north of the WVDP.

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On-site Ground-water	Groundwater monitoring wells around site is solid waste management units (SWMUs)	Grab liquid	4 times semiannually (8 samples yearly per well)**	136	Gross alpha/beta, H-3, gamma isotopic, chloride, sulfate, phenols, F, nitrate, TOC, TOX, As, Ba, Cs, Cr, Fe, Pb, Mn, Hg, Se, Ag, Na (Metals = total and soluble)
HLW Tank GW Monitoring Unit Wells: WNW 80-2 86-7 86-8 86-9 86-12* Surface: WNDMPNE*	<u>Reported:</u> Annual Environmental Monitoring Report	Direct measurement of sample discharge water	Before and after grab sample collection	272 (2 measurements per sample collection event)	Temperature, pH, conductivity
Lagoon GW Monitoring Unit Wells: WNW 86-6 86-3 86-4 86-5 80-6 Surface: WNGSEEP WNSP008					
NDA GW Monitoring Unit Wells: WNW 83-1D 86-10 86-11 82-1D					

* Serves former construction and demolition debris landfill (CDDL)

** Sampling and analysis conducted as outlined in the RCRA Groundwater Technical Enforcement Guidance Document (EPA OSWER 9950.1) and the Statistical Analysis of Monitoring Data at RCRA Facilities (EPA/530-SW-89-026).

SAMPLING RATIONALE

On-site Groundwater DOE Orders 5400.1, IV.9; Draft DOE 5400.6, V.11.a.(3); 40 CFR Part 264, Subpart F; and 40 CFR 265, Subpart F.

The on-site WVDP groundwater monitoring program focuses on radiological and chemical surveillance of both active and inactive solid waste management units (SWMUs). The program allows for the determination of water quality. In addition, using wells situated hydraulically upgradient (background) and downgradient of SWMUs allows for both detection of groundwater contamination and evaluation of the effects associated with the individual SWMUs.

The groundwater monitoring program is currently being expanded from three SWMUs to include eleven combined super SWMUs. This program expansion is covered in the "Sampling and Analysis Plan (SAP) Groundwater Monitoring Network," Draft W, October 1990, and in the Annual Site Groundwater Protection Management Program Plan, WVDP-091.

1990 EFFLUENT AND ON-SITE MONITORING PROGRAM

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On-site Ground-water	Groundwater monitoring wells around site facilities	Grab liquid	Semiannually	22* (2 per location)	Gross alpha/beta, H-3, gamma isotopic
Facility/Plant Area Wells: WNW 80-3 80-4	<u>Reported:</u> Annual Environmental Monitoring Report	Direct measurement of sample discharge water	Before and after grab sample collection	44* (two measurements per sample collection event)	Temperature, pH, conductivity
NDA Area Wells: WNW 82-1A 82-1B 82-1C 82-2B 82-2C 82-3A 82-4A1 82-4A2 82-4A3					
Fuel Storage Tank Subsurface Monitoring Well: WNW 86-13	<u>Reported:</u> Annual Environmental Monitoring Report	Grab liquid	Semiannually	2	Gross alpha/beta, H-3, gamma isotopic, phenols, TOC, benzene, toluene, xylene
		Direct measurement of discharge water	Before and after grab sample collection	4	Temperature, pH, conductivity

*Number of samples variable; occasionally wells are dry.

SAMPLING RATIONALE

Utility/ Plant Area Wells	DOE Orders 5400.1, IV.9; Draft DOE 5400.6, V.11.a.(3); and 40 CFR Parts 264 and 265, Subpart F. These wells monitor groundwater around site facilities. Sampling of these wells will be phased out when new wells installed for expanded solid waste management unit groundwater monitoring come on line. This program expansion is covered in the "Sampling and Analysis Plan (SAP) Groundwater Monitoring Network Report."
Fuel Storage Tank Subsurface Monitoring Well	DOE Orders 5400.1, IV.9; Draft DOE 5400.6, V.11.a.(3); and 40 CFR Parts 264 and 265, Subpart F. This well monitors groundwater in the vicinity of underground fuel storage tanks and is sampled primarily for radiological and selected indicator organic compounds. The PVC-cased well may be replaced by a stainless steel well during expansion of the groundwater monitoring program.

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Cattaraugus Creek at Felton Bridge WFFELBR	Unrestricted surface waters receiving plant effluents <u>Reported:</u> Monthly Environmental Monitoring Trend Analysis Annual Environmental Monitoring Report	Timed continuous composite liquid	Weekly *Weekly for monthly composite	52	Gross alpha/beta, H-3, pH. Flow-weighted monthly composite for gamma isotopic and Sr-90
Buttermilk Creek, Upstream of Cattaraugus Creek Confluence at Thomas Corners Road WFBCTCB	Restricted surface waters receiving plant effluents <u>Reported:</u> Annual Environmental Monitoring Report	Timed continuous composite liquid	*Biweekly	26	pH. Monthly for gross alpha/beta, H-3. Quarterly composite for gamma isotopic and Sr-90
Buttermilk Creek near Fox Valley WFBCKG	Restricted surface water background <u>Reported:</u> Monthly Environmental Monitoring Trend Analysis Annual Environmental Monitoring Report	Timed continuous composite liquid	*Biweekly	26	pH. Monthly for gross alpha/beta, H-3. Quarterly composite for gamma isotopic and Sr-90

*Samples are split with NYSDOH.

SAMPLING RATIONALE

WFFELBR Draft DOE 5400.6, V.11.a.(1).(a).

Since Buttermilk Creek is the surface water that receives all WVDP effluents and empties into Cattaraugus Creek, then WFFELBR monitors the potential influence of WVDP drainage into Cattaraugus Creek directly downstream of confluence with Buttermilk Creek.

WFBCTCB Draft DOE 5400.6, V.11.a.(1).(a).

Buttermilk Creek is the surface water receiving all WVDP effluents. WFBCTCB monitors the potential influence of WVDP drainage into Buttermilk Creek upstream of confluence with Cattaraugus Creek.

WFBCKBG Draft DOE 5400.6, V.11.a.(1).(b).

Monitors background conditions of Buttermilk Creek upstream of the WVDP. Allows for comparison to downstream conditions

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WFWEL Series Wells near WVDP outside WNYNSC Perimeter 3.0 km WNW WFWEL01 1.5 km NW WFWEL02 4.0 km NW WFWEL03 3.0 km NW WFWEL04 2.5 km SW WFWEL05 29 km S WFWEL06 (background) 4.0 km NNE WFWEL07 2.5 km ENE WFWEL08 3.0 km SE WFWEL09 7.0 km N WFWEL10	Drinking supply groundwater near facility <u>Reported:</u> Annual Environmental Monitoring Report	Grab liquid	Annual	10	Gross alpha/beta, H-3, gamma isotopic, pH, conductivity

SAMPLING RATIONALE

Off-site
Drinking
Water
WFWEL
Series

DOE 5400.1, IV.9; Draft DOE 5400.6, V.11.a.(3); and 40 CFR Parts 264 and 265, Subpart F.

Nine of the ten listed off-site private residential drinking water wells represent the nearest unrestricted uses of groundwater close to the WVDP. The tenth drinking water well, WFWEL06, is located 29 km south of the Project and is considered a background drinking water source.

1990 OFF-SITE MONITORING PROGRAM

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3.0 km SSE at Fox Valley AFFXVRD	Particulate air samples around WYNNSC perimeter	Continuous air particulate filter	Weekly	468 (52 per location)	Gross alpha/beta
3.7 km NNW at Thomas Corners Road AFTCORD	<u>Reported:</u> Annual Environmental Report				Quarterly composite for Sr-90, gamma isotopic
2.0 km NE on Route 240 AFRT240	Monthly Environmental Monitoring Trend Analysis (four sites only+)	Continuous desiccant column for water vapor collection	Weekly (2 sites only**)	104 (52 per site)	H-3
1.5 km NW on Rock Springs Road AFRSPRD		Continuous charcoal cartridge	Weekly (2 sites only**)	104 (52 per site)	Quarterly composite for I-129
29 km S at Great Valley (background) AFGRVAL					
7 km N at Springville AFSPRVL					
6 km SSE at West Valley AFWEVAL					
50 km W at Dunkirk (background) AFDNKRK					
2.3 km SW on Dutch Hill Road AFBOEHN					

+AFRT240, AFRSPRD, AFGRVAL and AFBOEHN.

**AFRSPRD and AFGRVAL.

SAMPLING RATIONALE

AFFXVRD Draft DOE 5400.6, V.8.d.
AFTCORD
AFRT240 Air samplers put into service by NFS as part of the site's original monitoring program. Perimeter locations chosen to obtain data from places most likely to provide highest concentrations, based on meteorological data. Sample heads are placed 4 meters above the ground.

Note: The remaining air sampling heads are positioned within the human breathing zone above ground.

AFRSPRD Perimeter location chosen to obtain data from the place most likely to provide highest ground-level release concentrations based on meteorological data. AFRSPRD is on WVDP property but outside the main plant operations fence line. I-129 and H-3 are sampled here because the sampling trains were easy to incorporate and the location was most likely to receive effluent releases.

AFBOEHN Perimeter location chosen to obtain data from the place most likely to provide highest elevated release concentrations based on meteorological data. AFBOEHN is located on privately owned property at the perimeter.

AFGRVAL DOE/EP-0023, 4.2.3.

Off-site (remote) sampler considered to be representative of natural background radiation. Located on privately owned property 29 km south of the site (typically upwind). I-129 and H-3 sampled here also.

AFDNKRK DOE/EP-0023, 4.2.3.

Off-site (remote) sampler considered to be representative of natural background radiation. Located 50 km west of the site (upwind) on privately owned property.

AFWEVAL DOE/EP-0023, 4.2.3.

Off-site (remote) sampler located on private property in nearby community within 15 km of the site (southeast).

AFSPRVL DOE/EP-0023, 4.2.3.

Off-site (remote) sampler located on private property in nearby community within 15 km of the site (north).

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2.5 km SW AFDHFOP	Collection of fallout particulate and precipitation around WNYNSC perimeter	Integrating liquid	Monthly	60 (12 per site)	Gross alpha/beta, H-3, pH
3.0 km SSE AFFXFOP					
3.7 km NNW AFTCFOP					
2.0 km NE AF24FOP					
Met Tower On- Site ANRGFOP					
Surface Soil (at each of nine air samplers plus 26 km SSW at Little Valley)	Long-term fallout accumulation	Surface plug composite soil	Annually	10	Gamma isotopic, Sr-90, Pu-239, Am-241 U-isotopic at SFRSPRD, SFBOEHN and SFGRVAL
SF Soil Series:					
Buttermilk Creek at Thomas Corners Road SFTCSED	Deposition in sediment downstream of facility effluents	Grab stream sediment	Semiannually 1st sample of SFBCSED and SFSDSED each spring*	10	Gross alpha/beta, isotopic gamma and Sr-90
Buttermilk Creek at Fox Valley Road (background) SFBCSED	<u>Reported:</u> Annual Environmental Monitoring Report		Annually (2 sites only**)	2	U/Pu isotopic, Am-241
Cattaraugus Creek at Springville Dam SFSDSED					
Cattaraugus Creek at Bigelow Bridge (background) SFBISED					
Cattaraugus Creek at Felton Bridge SFCCSED					

*Sample to be split with NYSDOH.

**Analysis on one of two semiannual collections at SFTCSED and SFBCSED.

SAMPLING RATIONALE

AFDHFOP DOE/EP-0023, 4.7.
AFFXFOP
AFTCFOP Collection of fallout particles and precipitation around the site perimeter established
AF24FOP air sampling locations. Indicates short-term effects.

ANRGFOP Collection of fallout particles and precipitation onsite at the meteorological tower.
Indicates short-term effects.

SF.. Draft DOE 5400.6, V.10 and DOE/EP-0023, 4.7.

SFWEVAL (West Valley), SFFXVRD (Fox Valley Road), SFSPRVL (Springville), SFTCORD (Thomas
Corners), SFRT240 (Route 240), SFDNKRK (Dunkirk), SFBOEHN (Boehn Road-Dutch Hill), SFGRVAL (Great
Valley), SFRSPRD (Rock Springs Road): Collection of long-term fallout data at established air
sampler locations via soil sampling.

SFTCSSED Sediment deposition in Buttermilk Creek immediately downstream of all facility liquid effluents.

SFBCESED Sediment deposition in Buttermilk Creek upstream of facility effluents (background).

SFCCSESED Sediment deposition in Cattaraugus Creek at Felton Bridge. Location is first access point of
Cattaraugus Creek downstream of the confluence with Buttermilk Creek.

SFSDSESED Sediment deposition in Cattaraugus Creek at Springville dam. Reservoir provides ideal settling
and collection location for sediments downstream of Buttermilk Creek confluence. Located
downstream of SFCCSESED.

SFBISESED Sediment deposition in Cattaraugus Creek at Bigelow Bridge. Location is upstream of the
Buttermilk Creek confluence and serves as a Cattaraugus Creek background location.

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Cattaraugus Creek downstream of the Buttermilk Creek Confluence BFFCATC*	Fish in waters up - and downstream of facility effluents <u>Reported:</u> Annual Environmental Monitoring Report	Individual collection, biological	Semiannually	5 (each sample is 10 fish)	Gamma isotopic and Sr-90 in edible portions of each individual fish
Control Sample from nearby stream not affected by WVDP (7 km or more upstream of site effluent point) BFFCTRL*					
Cattaraugus Creek downstream of Springville Dam BFFCATD			Annual	1 (each sample is 10 fish)	Gamma isotopic and Sr-90 in edible portions of each individual fish
Dairy Farm, 3.8 km NNW BFMREED*	Milk from animals foraging around facility perimeter	Grab biological	Monthly (BFMREED, BFMCOBO, BFMCTLS, BFMCTLN)	48 (12 per site)	Gamma isotopic, Sr-90, H-3, and I-129 of annual samples and quarterly composites of monthly samples
Dairy Farm, 1.9 km WNW BFMCOBO	<u>Reported:</u> Annual Environmental Monitoring Report				
Dairy Farm, 3.5 km SE of site BFMWIDR			Annual (BFMWIDR, BFMHAUR)	2	
Dairy Farm 2.5 km SSW BFMHAUR					
Control location 25 km S BFMCTLS					
Control location 30 km N BFMCTLN					

*Samples shared with NYSDOH.

SAMPLING RATIONALE

BFFCATC Draft DOE 5400.6, V.12.a.(1).
BFFCATD

Radioactivity may enter a food chain in which fish are a major component and are consumed by the local population.

BFFCTRL Draft DOE 5400.6, V.9.c.(1).

BFMREED Draft DOE 5400.6, V.9.c.(1).
BFMCOBO
BFMWIDR
BFMHAUR

Milk from animals foraging around facility perimeter. Milk is consumed by all age groups and is frequently the most important food that could contribute to the radiation dose. Dairy animals pastured near the site and at two background locations allow adequate monitoring.

BFMCTLS Background control samples collected far from site.
BFMCTLN

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Nearby locations BFVNEAR	Fruit and vegetables grown near facility perimeter downwind if possible	Grab biological (3 each)	*Annually, at harvest	6	Gamma isotopic and Sr-90 analysis of edible portions, H-3 in free moisture
Remote locations (16 km or more from facility) BFVCTRL	<u>Reported:</u> Annual Environmental Monitoring Report				
Beef cattle/ milk cow forage from near-site location N BFHNEAR		Grab biological	Annually	2	Gamma isotopic, Sr-90
Beef cattle/ milk cow forage from control south location or north location BFHCTLS or BFHCTLM					
Beef animal from nearby farm in downwind direction BFBNEAR	Meat-beef foraging near facility perimeter, downwind if possible	Grab biological	Semiannually	4	Gamma isotopic and Sr-90 analysis of meat, H-3 in free moisture
Beef animal from control location 16 km or more from facility BFBCTRL	<u>Reported:</u> Annual Environmental Monitoring Report				
In vicinity of the site (3) BFDNEAR	Meat-deer foraging near facility perimeter	Individual collection biological	*Annually, during hunting season	3	Gamma isotopic and Sr-90 analysis of meat, H-3 in free moisture
Control animals (3) 16 km or more from facility BFDCTRL	<u>Reported:</u> Annual Environmental Monitoring Report		*During year as available	3	

*Sample to be split with NYSDOH.

SAMPLING RATIONALE

BFVNEAR	Draft Doe 5400.6, V.9.c.(2). Fruits and vegetables collected from areas near the site. Collected, if possible, from areas near the site predicted to have worst case downwind concentrations of radionuclides in air and soil. Sample analysis reflects steady state/chronic uptake or contamination of foodstuffs as a result of site activities. Possible pathway to humans or indirectly through animals.
BFVCTRL	Draft DOE 5400.6, V.9.c.(2). Fruits and vegetables collected from area remote from the site. Background fruits and vegetables collected for comparison with near-site samples. Collected in areas(s) of no possible site impact.
BFHNEAR	Draft DOE 5400.6, V.9.c.(2). Hay collected from areas near the site. Same as for near-site fruits and vegetables (BFVNEAR). Indirect pathway to humans through animals. Collected with either beef or milk sample location.
BFHCTLS BFHCTLN	Draft DOE 5400.6, V.9.c.(2). Hay collected from areas remote from the site. Background hay collected for comparison with near-site samples. Collected in area(s) of no possible site impact.
BFBNEAR	DOE 5400.6, V.9.c.(3). Beef collected from animals raised near the site. Following the rationale for vegetable matter collected near site (BFVNEAR and BFHNEAR), edible flesh portion of beef animals is analyzed to determine possible radionuclide content passable directly to humans. For animals foraging downwind in areas of maximum probable site impact.
BFBCTRL	Draft DOE 5400.6, V.9.c.(3). Beef collected from animals raised far from the site. Background beef collected for comparison with near-site samples. Collected in area(s) of no possible site impact.
BFDNEAR	Draft DOE 5400.6, V.9.d. Venison from deer herd found living near the site. Same as for beef (BFBNEAR).
BFDCTRL	Draft DOE 5400.6, V.9.d. Venison from deer herd living far from the site. Background deer meat collected for comparison with near-site samples. Collected in area(s) of no possible site impact.

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Thermoluminescent Dosimetry (TLD) off-site: DFTLD Series	Direct radiation around facility	Integrating LiF TLD	Quarterly	460 (5 TLDs at each of 23 locations, collected 4 times per year)	Quarterly gamma radiation exposure
At each of 16 compass sectors, at nearest accessible perimeter point #1-16	<u>Reported:</u> Monthly Environmental Monitoring Trend Analysis Annual Environmental Monitoring Report				
"5 Points" land-fill, 19 km SW (background) #17					
1500 m NW (downwind receptor) #20					
Springville 7 km N #21					
West Valley 5 km SSE #22					
Great Valley, 29 km S (background) #23					
Dunkirk, 50 km NW (background) #37					
Sardinia-Savage Rd. 24 km NE (background) #41					

SAMPLING RATIONALE

DOSIMETRY off-site

Draft DOE 5400.6, V.7 and DOE/EP-0023, 4.6.3.

TLDs offer continuous integrated environmental gamma-ray monitoring and have been deployed systematically about the site. Off-site TLDs are used to verify that site activities have not adversely affected the surrounding environs.

In addition to general NRC crosschecks, a biennial HPIC gamma radiation measurement is completed at all TLD locations.

1990 EFFLUENT AND ON-SITE MONITORING PROGRAM

<u>SAMPLE LOCATION CODE</u>	<u>MONITORING/REPORTING REQUIREMENTS</u>	<u>SAMPLING TYPE/MEDIUM</u>	<u>COLLECTION FREQUENCY</u>	<u>TOTAL ANNUAL SAMPLES</u>	<u>ANALYSES PERFORMED/ COMPOSITE FREQUENCY</u>
Thermoluminescent Dosimetry (TLD) onsite: DNTLD Series	Direct radiation on facility grounds	Integrating LiF TLD	Quarterly	360 (5 TLDs at each of 18 sites collected 4 times per year)	Quarterly gamma radiation exposure
At three corners of SDA #18, #19, #33	<u>Reported:</u> Monthly Environmental Monitoring Trend Analysis				
(9) at security fence around site #24, 26-34	Annual Environmental Monitoring Report				
(5) on-site near operational areas #35, 36, 38-40					
Rock Springs Road 500 m NNW of plant #25					

SAMPLING RATIONALE

DOSIMETRY
on-site

Draft DOE 5400.6, V.7.

On-site TLDs monitor waste management units and verify that the potential dose rate to the general public, (i.e., Rock Springs Road), is below 100 mr/annum from site activities.

Potential TLD sampling locations are continually evaluated with respect to site activities.

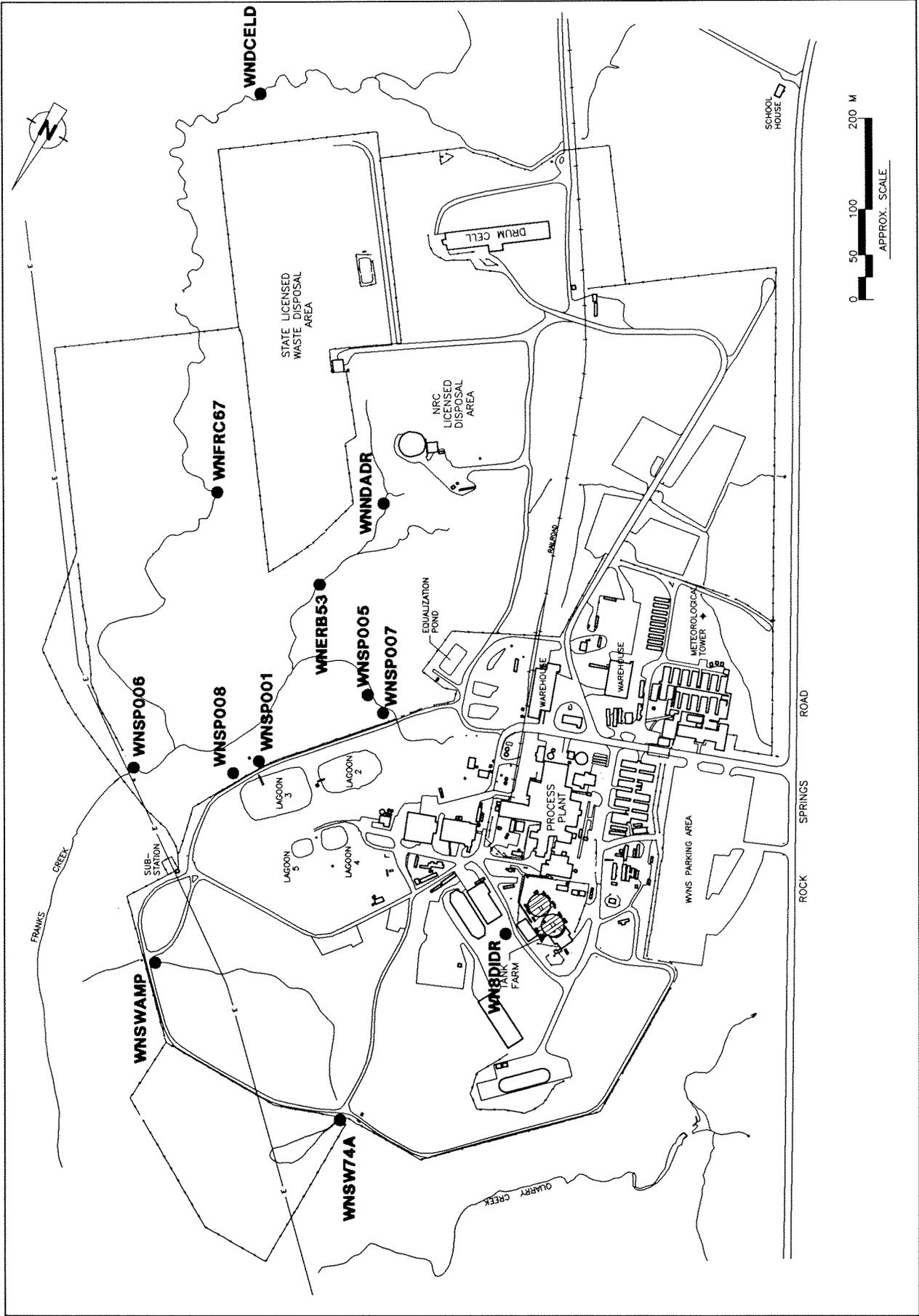


Figure A-2. Sampling Locations for On-Site Surface Water.

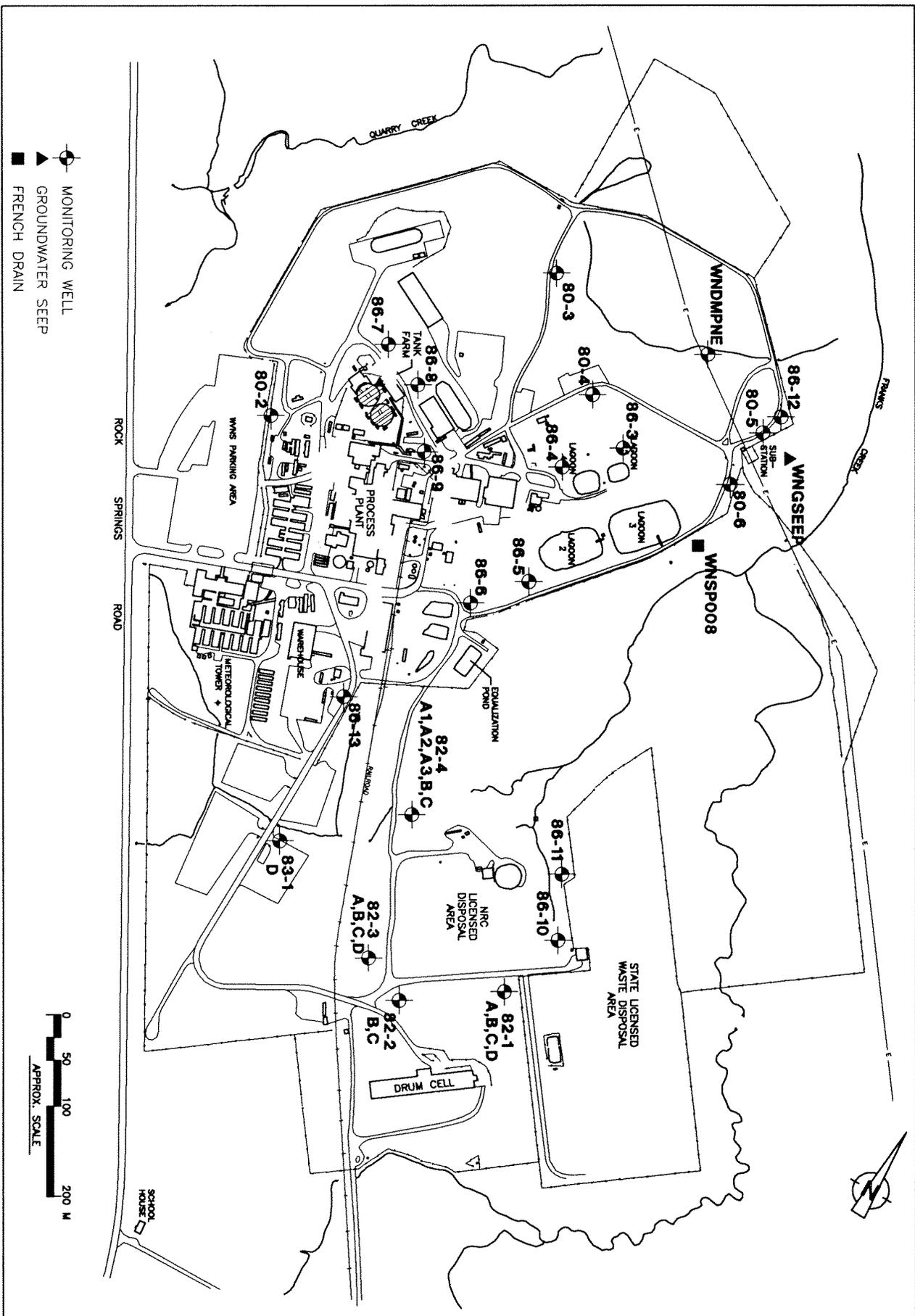


Figure A-3. Location of On-Site Groundwater Monitoring Points.

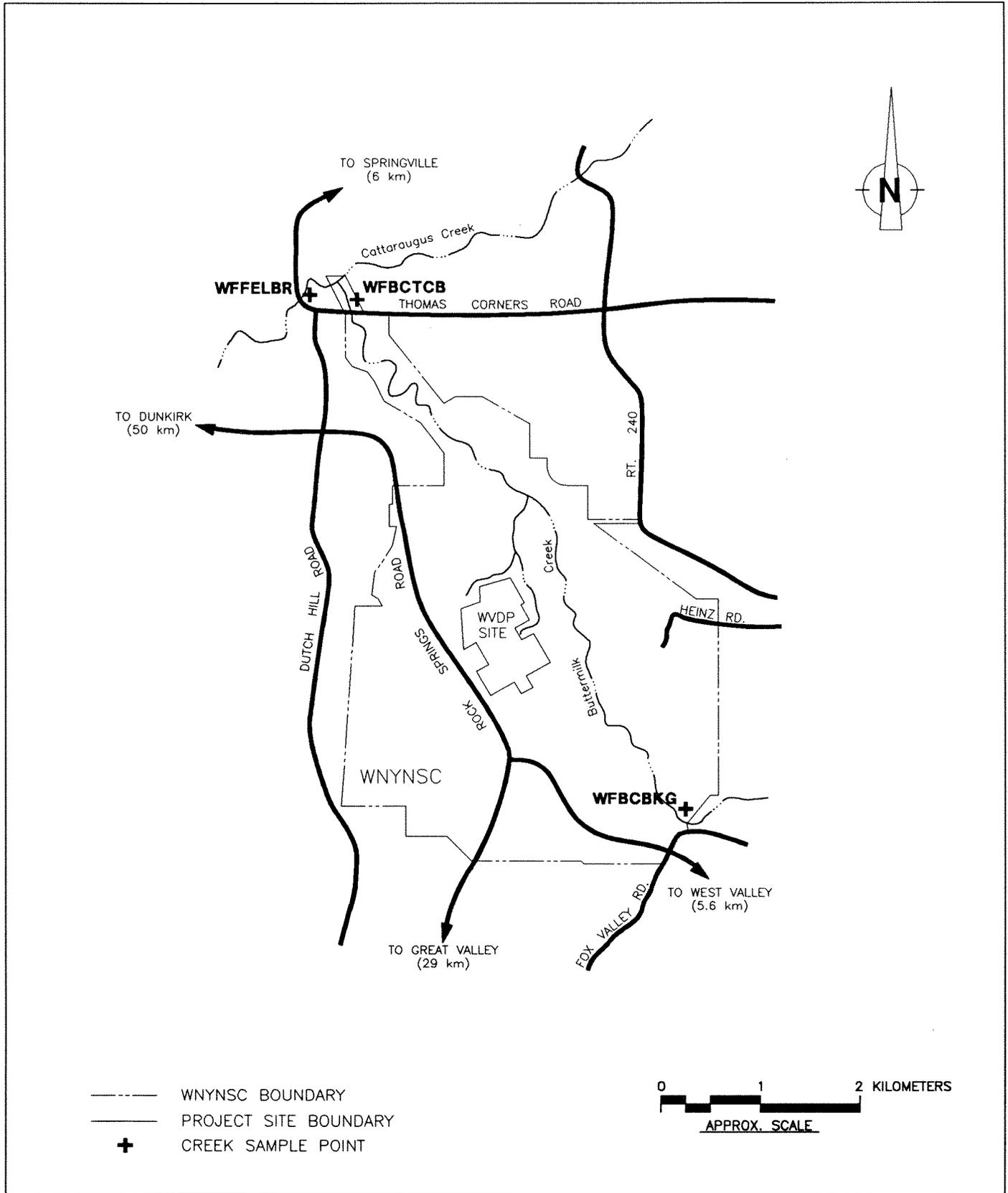


Figure A-4. Location of Off-Site Surface Water Samplers.

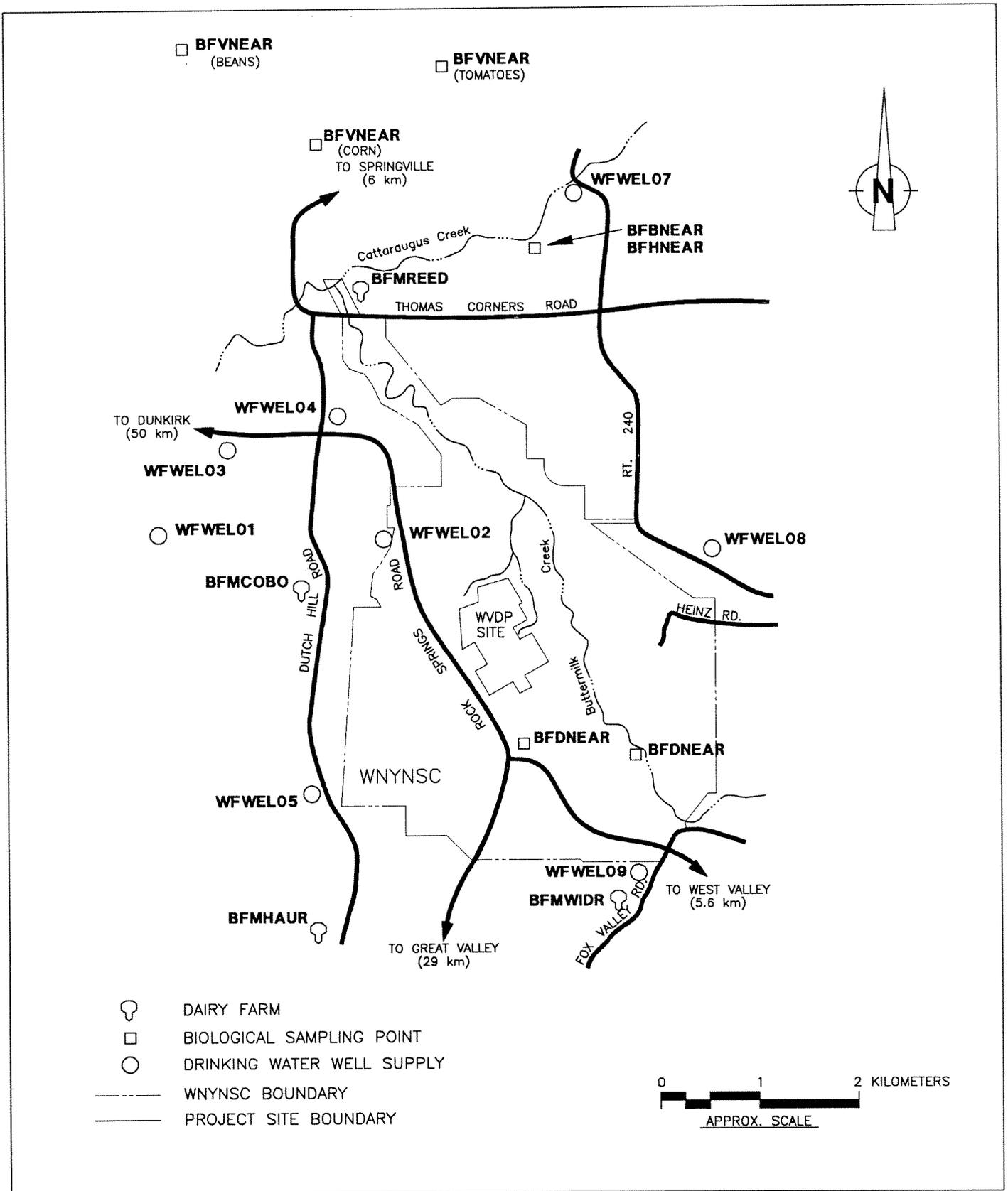


Figure A-5. Near-Site Drinking Water and Biological Sampling Points – 1990.

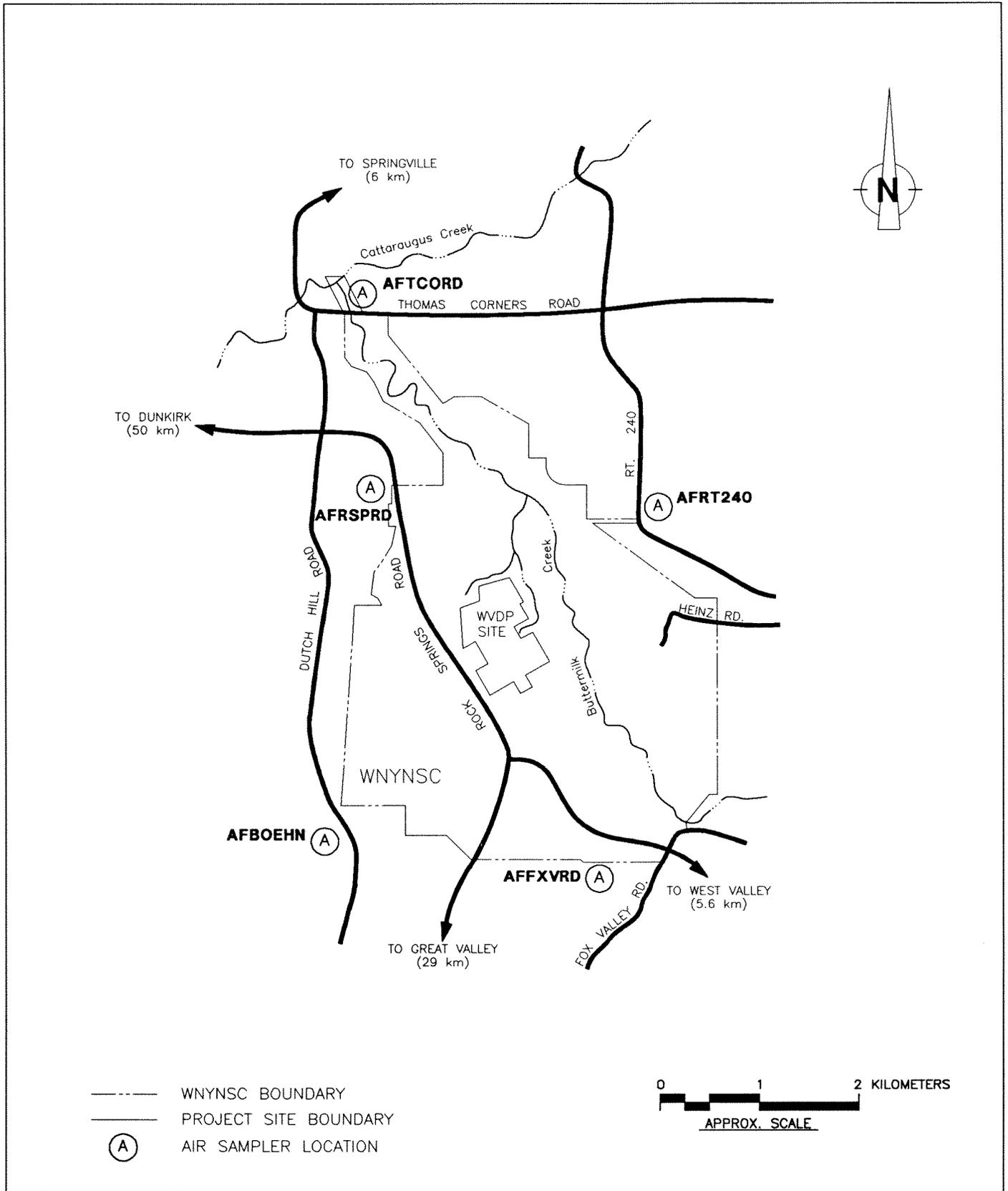


Figure A-6. Location of Perimeter Air Samplers.

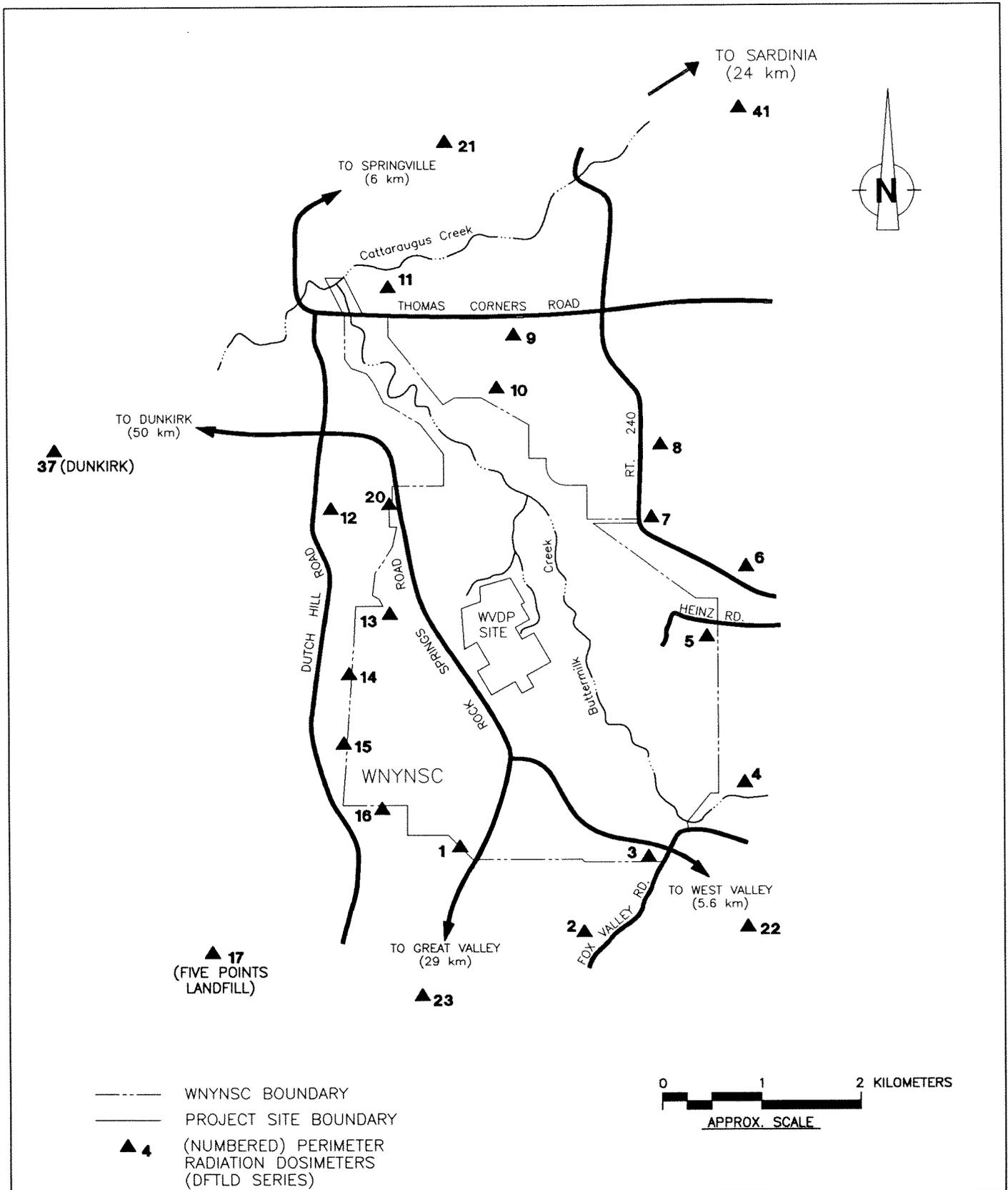
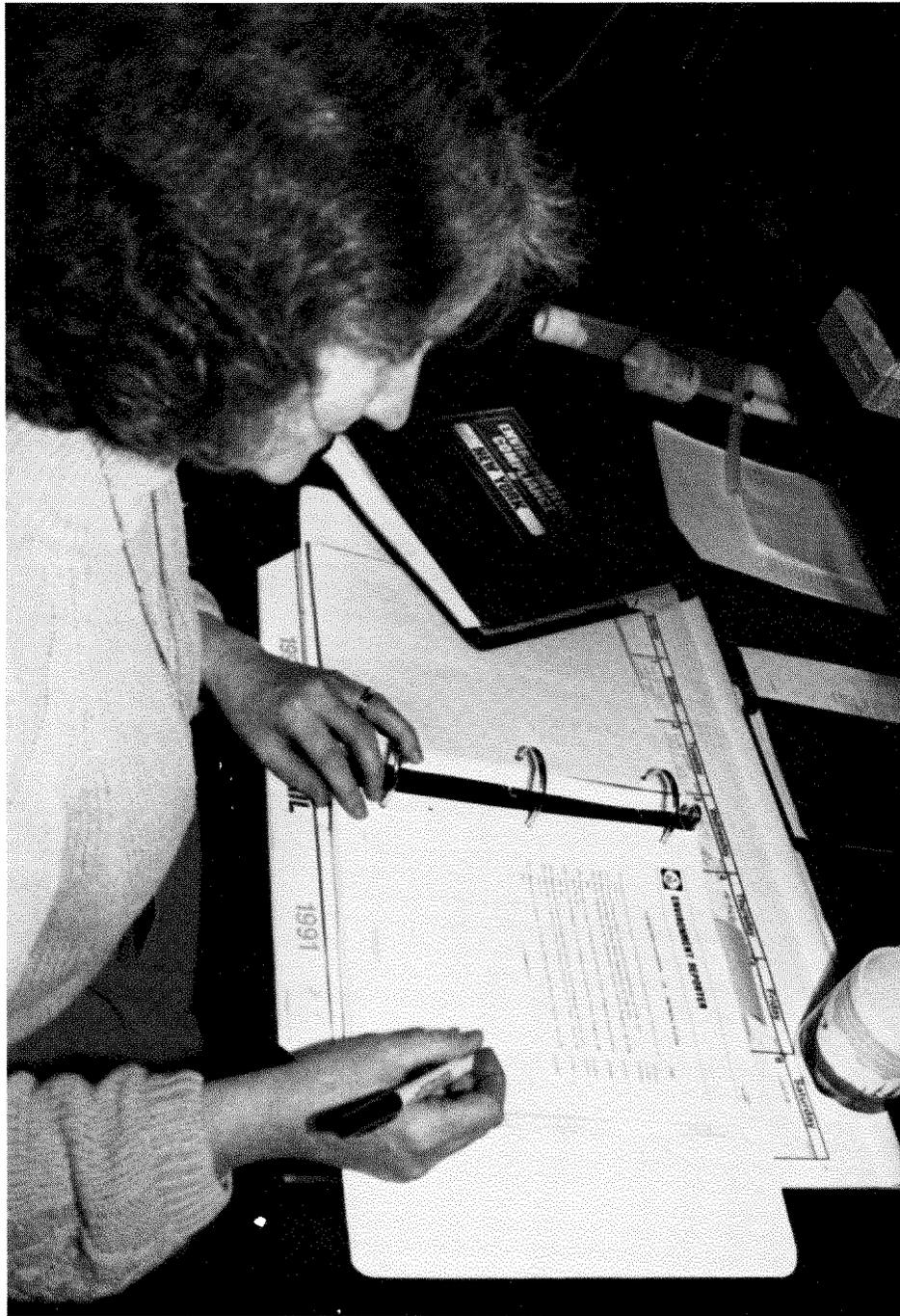
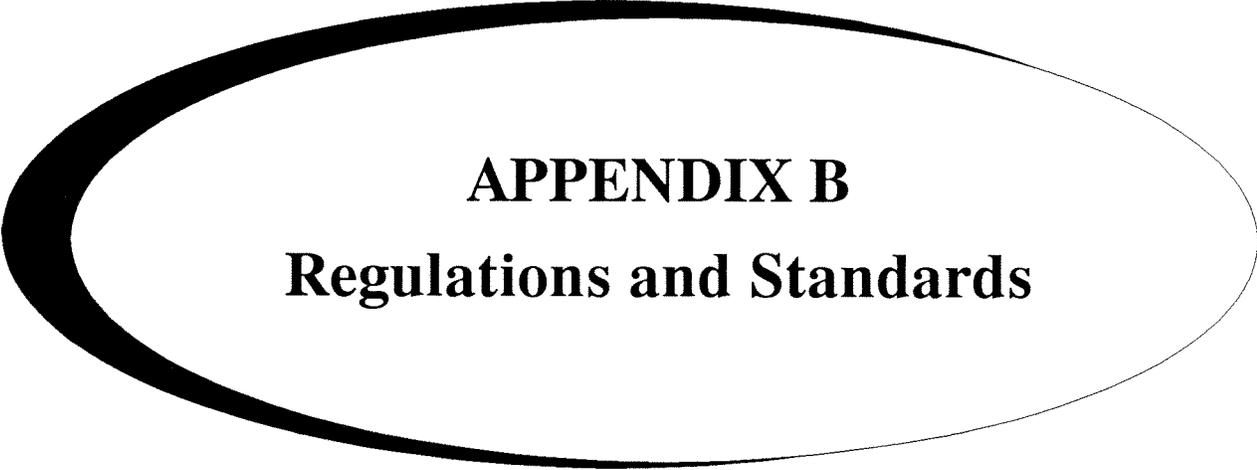


Figure A-7. Location of Off-Site Thermoluminescent Dosimetry (TLD).



Keeping Up with Regulatory Changes



APPENDIX B
Regulations and Standards

TABLE B - 1

**Department of Energy Radiation Protection Standards
and Concentration Guides ***

Effective Dose Equivalent Radiation Standard for Protection of the Public

Continuous exposure of any member of the public from routine activities:

100 mrem/year (1 mSv/year) from all exposure pathways

**Department of Energy Derived Concentration Guides (DCGs)
for Ingestion of Drinking Water and Inhaled Air ($\mu\text{Ci}/\text{mL}$)**

<u>Radionuclide:</u>	<i>In Air</i>	<i>In Water</i>	<u>Radionuclide:</u>	<i>In Air</i>	<i>In Water</i>
H-3	1E-07	2E-03	Th-232	7E-15	5E-08
C-14	6E-09	7E-05	U-233	9E-14	5E-07
Fe-55	5E-09	2E-04	U-234	9E-14	5E-07
Co-60	8E-11	5E-06	U-235	1E-13	6E-07
Ni-63	2E-09	3E-04	U-236	1E-13	5E-07
Sr-90	9E-12	1E-06	U-238	1E-13	6E-07
Zr-93	4E-11	9E-05	Np-239	5E-09	5E-05
Nb-93m	4E-10	3E-04	Pu-238	3E-14	4E-08
Tc-99	2E-09	1E-04	Pu-239	2E-14	3E-08
Ru-106	3E-11	6E-06	Pu-240	2E-14	3E-08
Rh-106m	6E-08	2E-04	Pu-241	1E-12	2E-06
Sb-125	1E-09	5E-05	Am-241	2E-14	3E-08
Te-125m	2E-09	4E-05	Am-243	2E-14	3E-08
I-129	7E-11	5E-07	Cm-243	3E-14	5E-08
Cs-134	2E-10	2E-06	Cm-244	4E-14	6E-08
Cs-135	3E-09	2E-05	Gross Alpha		
Cs-137	4E-10	3E-06	(as Am-241)	2E-14	3E-08
Pm-147	3E-10	1E-04	Gross Beta		
Sm-151	4E-10	4E-04	(as Ra-228)	3E-12	1E-07
Eu-152	5E-11	2E-05			
Eu-154	5E-11	2E-05			
Eu-155	3E-10	1E-04			

* Ref: DOE Order 5400.5 (February 8, 1990). Effective May 8, 1990.

Environmental Standards and Regulations

The following environmental standards and laws are applicable, in whole or in part, to the West Valley Demonstration Project:

DOE Order 5400.1, "General Environmental Protection Program," November 1988.

DOE Order 5480.1, "Requirements for Radiation Protection," August 1981.

DOE Order 5480.1A, "Environmental Protection, Safety, and Health Protection Program for DOE Operations," August 1981.

DOE Order 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements," February 1981.

Clean Air Act. 42 USC 1857 et seq., as amended, and implementing regulations.

Federal Water Pollution Control Act (Clean Water Act). 33 USC 1251, as amended, and implementing regulations.

Resource Conservation and Recovery Act. 42 USC 6905, as amended, and implementing regulations.

National Environmental Policy Act, PL 911-190. 42 USC 4321-4347, January 1, 1970, as amended, and implementing regulations.

Comprehensive Environmental Response, Compensation, and Liability Act. 42 USC 960 (including Superfund Amendments and Reauthorization Act of 1986), and implementing regulations.

Toxic Substances Control Act. 15 USC 2610, as amended, and implementing regulations.

Environmental Conservation Law of New York State.

The standards and guidelines applicable to releases of radionuclides from the West Valley Demonstration Project are found in DOE Order 5400.5.

Ambient water quality standards contained in the State Pollutant Discharge Elimination System (SPDES) permit issued for the facility are listed in Table C - 5.1 in Appendix C - 5. Airborne discharges are also regulated by the Environmental Protection Agency under the National Emission Standards for Hazardous Air Pollutants, 40 CFR 61. 1984.

The above list covers the major activities at the West Valley Demonstration Project but does not constitute a comprehensive enumeration.

TABLE B - 3

West Valley Demonstration Project Environmental Permits
Calendar Year 1990

Permit Number	Issued by	Expiration	Type of Permit
042200-0114-00002 WC	NYSDEC	9/94	Certificate to Operate Air Contamination Source: Boiler
042200-0114-00003 WC	NYSDEC	9/94	Certificate to Operate Air Contamination Source: Boiler
042200-0114-00004 WR	NYSDEC	9/94	Certificate to Operate Air Contamination Source: Incinerator ¹
042200-0114-0010 WI	NYSDEC	9/94	Certificate to Operate Air Contamination Source: Low-level Waste Treatment Facility Nitric Acid Storage Tank
042200-0114-014D1 WI	NYSDEC	9/94 ²	Certificate to Operate Air Contamination Source: Nitric Acid Bulk Storage Tank Vent
042200-0114-CSS01	NYSDEC	9/94	Certificate to Operate Air Contamination Source: Cement Storage Silo Ventilation System
042200-0114-15F-1	NYSDEC	9/94 ³	Certificate to Operate Air Contamination Source: Analytical & Process Chemistry Laboratory Equipment
042200-0114-33157	NYSDEC	9/94	Certificate to Operate Air Contamination Source: Tank #33157 Vent
042200-0114-33154	NYSDEC	9/94	Certificate to Operate Air Contamination Source: Tank #33154 Vent
042200-0114-14D-2	NYSDEC	9/94	Certificate to Operate Air Contamination Source: Tank #14D-2 Vent
042200-0114-14D2A	NYSDEC	9/94	Certificate to Operate Air Contamination Source: Tank #14D-2A Vent
NY-0000973	NYSDEC	9/90 ⁴	State Pollutant Discharge Elimination System (SPDES) permit
WVDP-187-01	EPA		Certificate to Operate Radioactive Air Source: Building 01-14 Ventilation System ⁵
WVDP-287-01	EPA		Certificate to Operate Radioactive Air Source: Contact Size Reduction & Decontamination Facility ⁵

TABLE B - 3 (concluded)

West Valley Demonstration Project Environmental Permits
Calendar Year 1990

Permit Number	Issued by	Expiration	Type of Permit
WVDP-387-01	EPA		Certificate to Operate Radioactive Air Source: Supernatant Treatment Ventilation System ⁵
WVDP-487-01	EPA		Certificate to Operate Radioactive Air Source: Low-level Waste Supercompactor Ventilation System ⁵
WVDP-587-01	EPA		Certificate to Operate Radioactive Air Source: Outdoor Ventilation System ⁵
WVDP-687-01	EPA		Certificate to Operate Radioactive Air Source: Process Building Ventilation System ⁵
PRT-747595	U.S. DOI FISH & WILDLIFE SERVICE; NYSDEC	12/31/90 ⁶	Depredation Permit
N/A ⁷	NYSDEC	N/A ⁷	Hazardous Waste Treatment and Storage Interim Status Application (RCRA Part A)

¹ Nonradioactive waste is removed to a commercial landfill and is not incinerated. The permit became inactive in February 1990.

² Permit was terminated during 1990.

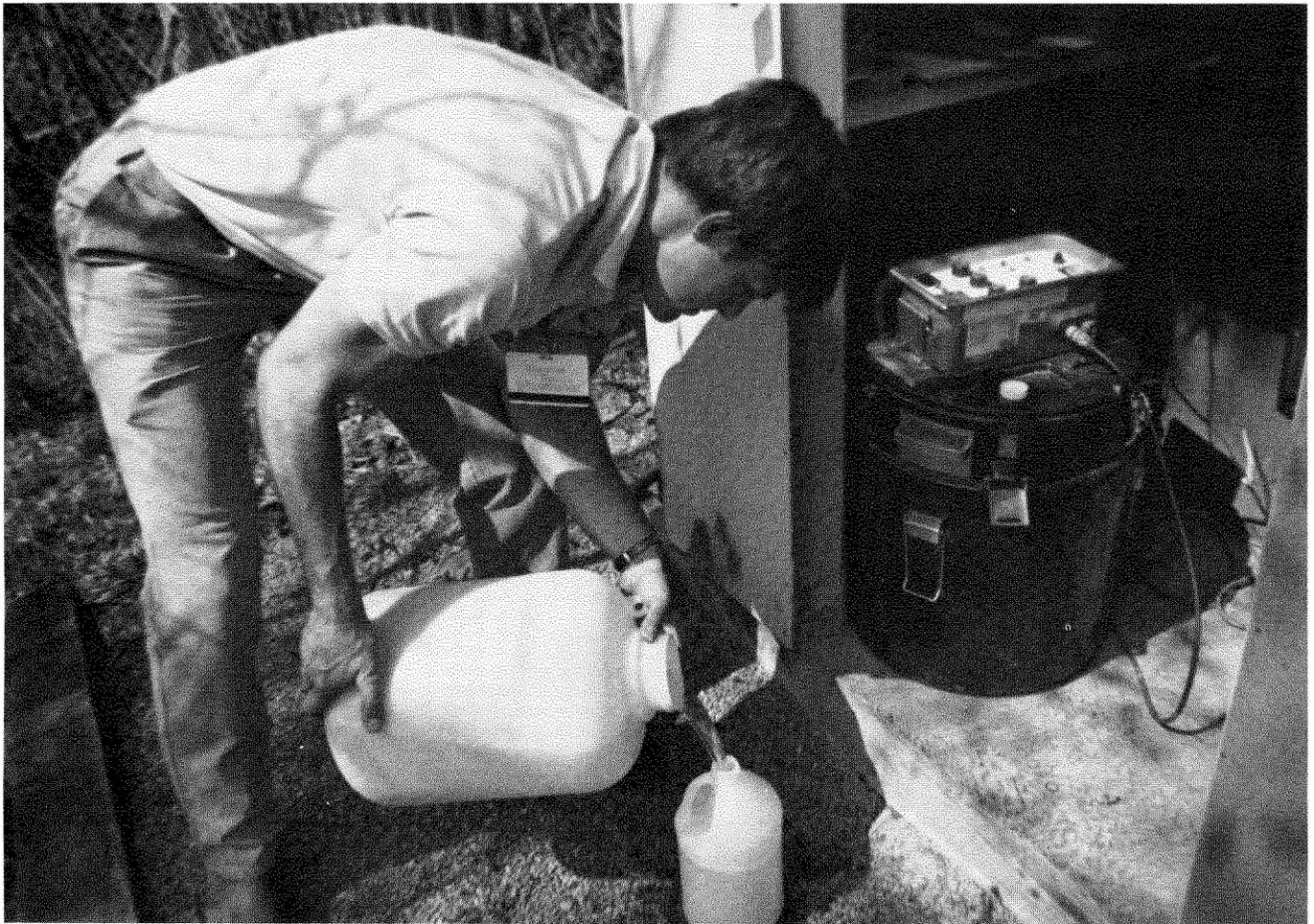
³ Application pending in 1990 for this process. Approval documentation received January 1991.

⁴ Renewal application was submitted to the New York State Department of Environmental Conservation in May 1990.

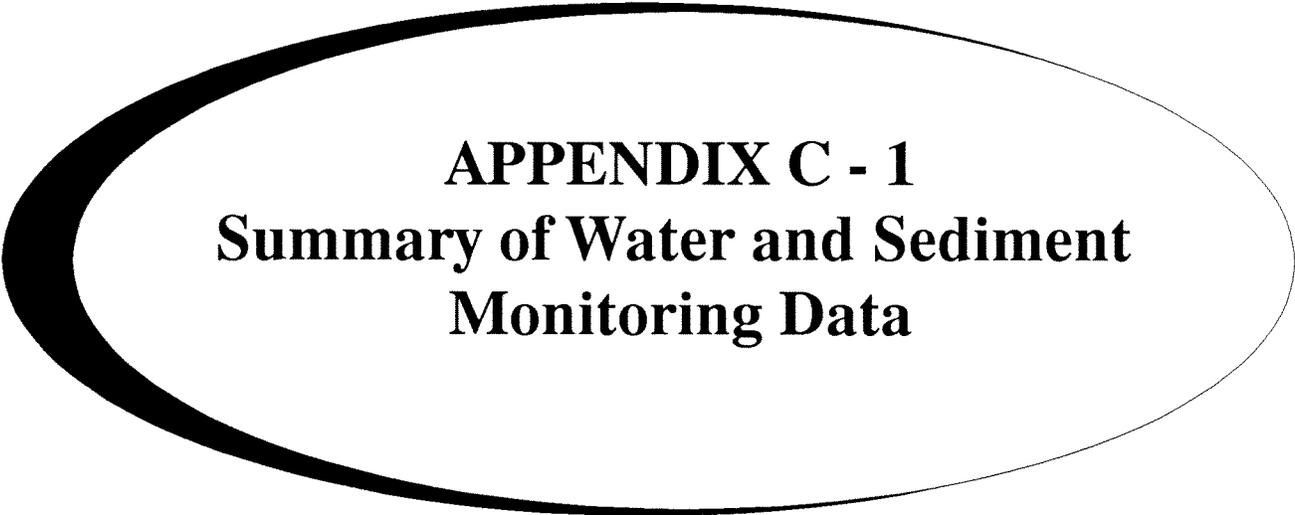
⁵ National Emission Standards for Hazardous Air Pollutants (NESHAP) temporary permits are valid until the final permits are issued.

⁶ Permit renewal request submitted to Fish and Wildlife Service in January 1991.

⁷ Will operate under interim status until NYSDEC requests Part B of RCRA application.



Collecting a Sample at a Continuous-Stream Sample Station



APPENDIX C - 1
Summary of Water and Sediment
Monitoring Data

TABLE C - 1.1

Total Radioactivity of Liquid Effluents Released from WVDP Lagoon 3 in 1990 (curies)

	Alpha	Beta	H-3	C-14	Sr-90	I-129	Cs-137
1ST QTR	6.33 ± 4.1 E-04	1.51 ± 0.1 E-02	2.38 ± 0.05 E+00	9.09 ± 0.5 E-04	1.09 ± 0.1 E-03	1.30 ± 0.6 E-04	3.46 ± 1.0 E-03
2ND QTR	1.36 ± 0.8 E-04	1.51 ± 0.1 E-02	9.86 ± 0.03 E-01	3.30 ± 0.4 E-03	4.90 ± 0.5 E-04	<5.5 E-05	4.54 ± 0.4 E-03
3RD QTR	***	-----	No release this quarter		-----		
4TH QTR	2.21 ± 1.1 E-04	1.42 ± 0.1 E-02	1.05 ± 0.03 E+00	<2.7 E-03	9.42 ± 0.7 E-04	2.04 ± 0.3 E-04	3.94 ± 0.5 E-03
1990 Totals	9.90 ± 4.3 E-04	4.44 ± 0.2 E-02	4.42 ± .06 E+00	6.91 ± 2.7 E-03	2.50 ± 0.1 E-03	3.89 ± 0.9 E-04	1.19 ± 0.1 E-02
1990 Average (μ Ci/mL)	2.36 E-08	1.07 E-06	1.06 E-04	1.65 E-07	5.97 E-08	9.28 E-09	2.84 E-07
	U-232	U-234	U-235	U-238	Pu-238	Pu-239/240	Am-241
1ST QTR	N/A	1.00 ± 0.1 E-04	3.09 ± 1.6 E-06	3.42 ± 0.5 E-05	2.31 ± 1.3 E-06	1.73 ± 1.2 E-06	5.95 ± 2.0 E-06
2ND QTR	*9.47 ± 1.0 E-04	3.32 ± 0.5 E-04	1.37 ± 0.6 E-05	1.01 ± 0.2 E-04	1.34 ± 1.2 E-06	<8.1 E-07	1.03 ± 0.9 E-06
3RD QTR	****	-----	No release this quarter		-----		
4TH QTR	*2.78 ± 0.3 E-04	1.38 ± 0.2 E-04	6.94 ± 2.8 E-06	5.33 ± 0.9 E-05	N/A	N/A	6.75 ± 2.7 E-07
1990 Totals	N/A	5.70 ± 0.5 E-04	2.37 ± 0.7 E-05	1.89 ± 0.2 E-04	3.65 ± 1.8 E-06	2.5 ± 1.2 E-06	7.66 ± 2.3 E-06
1990 Average (μ Ci/mL)	N/A	1.36 E-08	5.66 E-10	4.51 E-09	6.71 E-11	5.97 E-11	1.83 E-10

* Calculated values for U-232 are provisional, pending resolution of analytical uncertainties.

N/A Not available

TABLE C - 1.2

Comparison of 1990 Lagoon 3 Liquid Effluent Radioactivity Concentrations
with Department of Energy (DOE) Guidelines

ISOTOPE	Total (μCi) Released ^a	Avg conc. ($\mu\text{Ci/mL}$)	DCG ($\mu\text{Ci/mL}$)	% of DCG
Alpha	9.90 E + 02	2.36 E-08	Not applicable ^b	-----
Beta	4.44 E + 04	1.07 E-06	Not applicable ^b	-----
H-3	4.42 E + 06	1.06 E-04	2.0 E-03	5.3
C-14	6.91 E + 03	1.65 E-07	7.0 E-05	0.2
Sr-90	2.50 E + 03	5.97 E-08	1.0 E-06	6.0
I-129	3.89 E + 02	9.28 E-09	5.0 E-07	1.9
Cs-137	1.19 E + 04	2.84 E-07	3.0 E-06	9.5
U-234 ^c	5.70E + 02	1.36E-08	5.0 E-07	2.7
U-235 ^c	2.37E + 01	5.66E-10	6.0 E-07	0.1
U-238 ^c	1.89E + 02	4.51E-09	6.0 E-07	0.8
Pu-238	3.65 E + 00	8.71 E-11	4.0 E-08	0.2
Pu-239	2.50 E + 00	5.97 E-11	3.0 E-08	0.2
Am-241	7.66E + 00	1.83E-10	3.0 E-08	0.6
TOTAL % OF DCG				28.0^d

^a Total volume released = $4.19\text{E} + 10$ mL measured at actual on-site release point.

^b Derived Concentration Guides (DCGs) are not applicable for gross alpha or beta activity.

^c Total U (μg) = $5.79\text{E} + 08$; average U (mg/L) = $1.38\text{E}-02$.

^d Total percent DCG for specific measured radionuclides does not include % of DCG for U-232 because of analytical uncertainties. Total % DCG including provisional reporting of U-232 would be 86.2% for 1990.

TABLE C - 1.3
1990 Radioactivity Concentrations ($\mu\text{Ci/mL}$)
in Surface Water Upstream of the WVDP at Fox Valley (WFBCBKG)

MONTH	Alpha	Beta	H-3	Sr-90	Cs-137
JAN	<8.2 E-10	3.01 \pm 1.1 E-09	<1.0 E-07		
FEB	<1.0 E-09	4.47 \pm 1.2 E-09	<1.0 E-07		
MAR	<6.6 E-10	1.94 \pm 0.9 E-09	<1.0 E-07		
1ST QTR				<1.4 E-09	<1.1 E-08
APR	1.44 \pm 1.1 E-09	2.53 \pm 0.9 E-09	<1.0 E-07		
MAY	<7.0 E-10	2.62 \pm 1.0 E-09	<1.0 E-07		
JUN	<8.0 E-10	2.58 \pm 1.0 E-09	<1.0 E-07		
2ND QTR				8.59 \pm 2.6 E-09	<1.1 E-08
JUL	1.44 \pm 1.3 E-09	2.29 \pm 1.1 E-09	<1.0 E-07		
AUG	<1.0 E-09	2.80 \pm 1.1 E-09	<1.0 E-07		
SEP	<1.5 E-09	2.95 \pm 1.3 E-09	<1.0 E-07		
3RD QTR				3.40 \pm 2.1 E-09	<1.1 E-08
OCT	<1.1 E-09	3.67 \pm 1.3 E-09	<1.0 E-07		
NOV	<1.4 E-09	<1.7 E-09	<1.0 E-07		
DEC	<3.4 E-09	5.86 \pm 2.6 E-09	<1.0 E-07		
4TH QTR				6.94 \pm 2.5 E-09	<1.1 E-08

TABLE C - 1.4
1990 Radioactivity Concentrations ($\mu\text{Ci/mL}$)
in Surface Water Downstream of the WVDP at Thomas Corners (WFBCTCB)

MONTH	Alpha	Beta	H-3	Sr-90	Cs-137
JAN	1.83 \pm 1.5 E-09	2.89 \pm 1.1 E-09	<1.0 E-07		
FEB	<5.5 E-10	4.53 \pm 1.2 E-09	2.07 \pm 1.2 E-07		
MAR	1.21 \pm 1.1 E-09	6.42 \pm 1.3 E-09	3.11 \pm 1.2 E-07		
1ST QTR				1.68 \pm 1.6 E-09	<1.1 E-08
APR	<6.0 E-10	3.51 \pm 1.0 E-09	<1.0 E-07		
MAY	<7.1 E-10	3.50 \pm 1.1 E-09	1.24 \pm 1.1 E-07		
JUN	<1.0 E-09	1.15 \pm 0.2 E-08	5.63 \pm 1.2 E-07		
2ND QTR				4.38 \pm 2.0 E-09	<1.1 E-08
JUL	<1.4 E-09	5.46 \pm 1.3 E-09	1.92 \pm 1.2 E-07		
AUG	2.19 \pm 1.7 E-09	5.69 \pm 1.4 E-09	<1.0 E-07		
SEP	<1.3 E-09	4.08 \pm 1.3 E-09	<1.0 E-07		
3RD QTR				4.19 \pm 1.9 E-09	<1.1 E-08
OCT	<2.5 E-09	5.88 \pm 1.5 E-09	<1.0 E-07		
NOV	<1.4 E-09	6.44 \pm 2.2 E-09	1.23 \pm 1.2 E-07		
DEC	<1.9 E-09	3.67 \pm 2.2 E-09	<1.0 E-07		
4TH QTR				4.07 \pm 2.3 E-09	<1.1 E-08

TABLE C - 1.5

**Radioactivity Concentrations ($\mu\text{Ci/mL}$)
in Surface Water Downstream of the WVDP at Frank's Creek (WNSP006)**

MONTH	Alpha	Beta	H-3
January	2.90 \pm 2.0 E-09	4.39 \pm 0.3 E-08	5.81 \pm 0.3 E-06
February	< 1.35 E-09	2.26 \pm 0.2 E-08	< 1.00 E-07
March	1.53 \pm 1.5 E-09	5.50 \pm 0.5 E-08	7.11 \pm 0.3 E-06
April	< 1.19 E-09	3.82 \pm 0.3 E-08	3.13 \pm 0.2 E-06
May	< 1.40 E-09	2.85 \pm 0.3 E-08	1.41 \pm 1.1 E-07
June	7.09 \pm 5.2 E-09	3.77 \pm 0.1 E-07	2.58 \pm 0.1 E-05
July	< 2.40 E-09	1.67 \pm 0.1 E-07	1.18 \pm 0.1 E-06
August	< 3.90 E-09	2.03 \pm 0.1 E-07	9.25 \pm 1.2 E-07
September	< 1.84 E-09	7.09 \pm 0.7 E-08	3.19 \pm 1.2 E-07
October	< 1.50 E-09	2.65 \pm 0.4 E-08	2.15 \pm 1.2 E-07
November	3.35 \pm 2.8 E-09	1.54 \pm 0.1 E-07	1.15 \pm 0.1 E-05
December	< 1.44 E-09	1.68 \pm 0.3 E-08	< 1.00 E-07

TABLE C - 1.6

**Radioactivity Concentrations ($\mu\text{Ci/mL}$)
in Surface Water Downstream of the WVDP at Frank's Creek (WNSP006)**

1990	C-14	Sr-90	I-129	Cs-137	U-234
1ST QTR	8.36 \pm 1.03 E-07	1.52 \pm 0.3 E-08	< 4.9 E-09	1.30 \pm 1.1 E-08	4.00 \pm 0.77 E-09
2ND QTR	1.12 \pm 0.22 E-07	2.96 \pm 0.4 E-08	< 4.95 E-09	4.05 \pm 2.1 E-08	2.48 \pm 0.49 E-08
3RD QTR	< 5.04 E-08	4.63 \pm 0.5 E-08	< 1.14 E-09	1.53 \pm 1.4 E-08	7.77 \pm 2.55 E-10
4TH QTR	< 2.40 E-08	1.57 \pm 0.5 E-08	< 1.14 E-09	1.50 \pm 1.1 E-08	7.54 \pm 2.96 E-10
	U-235	U-238	Pu-238	Pu-239/240	Am-241
1ST QTR	< 2.9 E-10	4.32 \pm 2.42 E-10	< 7.4 E-11	< 7.4 E-11	2.58 \pm 1.29 E-10
2ND QTR	1.92 \pm 1.51 E-09	8.63 \pm 2.72 E-09	< 5.81 E-11	< 4.77 E-11	< 1.91 E-10
3RD QTR	< 1.33 E-10	4.51 \pm 2.00 E-10	7.46 \pm 6.21 E-11	< 4.35 E-11	1.49 \pm 1.23 E-10
4TH QTR	2.30 \pm 1.94 E-10	1.28 \pm 0.38 E-09	1.14 \pm 0.83 E-10	1.42 \pm 0.93 E-10	< 8.05 E-11

TABLE C - 1.7

**Radioactivity Concentrations (μ Ci/mL) in Surface Water
Downstream of Buttermilk Creek at Felton Bridge (WFFELBR)**

1990	Alpha	Beta	H-3	Sr-90	Cs-137
January	<1.5 E-08	3.43 \pm 1.1 E-09	<1.0 E-07	2.40 \pm 1.4 E-09	<1.1 E-08
February	<7.5 E-10	3.57 \pm 1.2 E-09	<1.0 E-07	<1.3 E-09	<1.1 E-08
March	<1.1 E-09	3.33 \pm 1.1 E-09	<1.0 E-07	<1.1 E-09	<1.1 E-08
April	<7.3 E-10	3.63 \pm 1.1 E-09	<1.0 E-07	1.39 \pm 1.37 E-09	<1.1 E-08
May	<1.2 E-09	4.13 \pm 1.2 E-09	<1.0 E-07	<1.7 E-09	<1.1 E-08
June	<1.4 E-09	2.03 \pm 1.1 E-09	1.35 \pm 1.1 E-07	<1.5 E-09	<1.1 E-08
July	<2.2 E-09	3.81 \pm 1.4 E-09	<1.0 E-07	<1.6 E-09	<1.1 E-08
August	<1.3 E-09	3.29 \pm 1.4 E-09	<1.0 E-07	<1.4 E-09	<1.1 E-08
September	<1.3 E-09	3.21 \pm 1.3 E-09	<1.0 E-07	2.00 \pm 1.96 E-09	<1.1 E-08
October	6.59 \pm 3.9 E-09	7.28 \pm 1.7 E-09	<1.0 E-07	3.87 \pm 2.1 E-09	<1.1 E-08
November	3.62 \pm 2.6 E-09	3.44 \pm 1.3 E-09	<1.0 E-07	<2.1 E-09	<1.1 E-08
December	<2.8 E-09	4.26 \pm 2.4 E-09	<1.0 E-07	<1.7 E-09	<1.1 E-08

TABLE C - 1.8

1990 Results for Potable Well Water Sampled around the WVDP Site

Sample ID	pH	Conductivity*	Alpha**	Beta**	H-3**	Cs-137**
WFWEL01	7.58	372	<7.0 E-10	2.22 \pm 1.69 E-09	<1.14 E-07	<3.7 E-08
WFWEL02	6.70	296	1.25 \pm 1.22 E-09	5.90 \pm 1.51 E-09	<1.0 E-07	<3.7 E-08
WFWEL03	6.99	872	<3.08 E-09	2.24 \pm 1.98 E-09	<1.07 E-07	<3.7 E-08
WFWEL04	8.14	1610	<1.66 \pm 1.63 E-08	<2.34 E-09	<7.85 E-08	<3.7 E-08
WFWEL05	6.30	321	<7.99 E-10	2.58 \pm 1.69 E-09	<1.0 E-07	<3.7 E-08
WFWEL06	7.95	263	<6.62 E-10	<1.45 E-09	<1.0 E-07	<3.7 E-08
WFWEL07	7.70	314	<8.14 E-10	2.51 \pm 1.40 E-09	<1.0 E-07	<3.7 E-08
WFWEL08	7.44	457	1.93 \pm 1.90 E-09	2.97 \pm 1.84 E-09	<1.11 E-07	<3.7 E-08
WFWEL09	7.91	626	<1.5 E-09	2.66 \pm 1.84 E-09	<1.05 E-07	<3.7 E-08
WFWEL10	7.26	583	<9.96 E-10	<1.56 E-09	<1.0 E-07	<3.7 E-08

* μ mhos/cm@25⁰C

** μ Ci/mL

TABLE C - 1.9

1990 Radioactivity Concentrations in Stream Sediment around the WVDP Site
($\mu\text{Ci/g}$ dry weight from upper 15 cm)

Location	Date	Alpha	Beta	K-40	Cs-137	Sr-90	Co-60
SFBCSED	June 1990	$1.99 \pm 0.88 \text{ E-05}$	$1.87 \pm 0.55 \text{ E-05}$	$1.63 \pm 0.28 \text{ E-05}$	$5.48 \pm 5.38 \text{ E-08}$	$1.83 \pm 0.60 \text{ E-07}$	$< 1.0 \text{ E-07}$
SFSDSED	June 1990	$2.61 \pm 1.07 \text{ E-05}$	$1.92 \pm 0.54 \text{ E-05}$	$1.33 \pm 0.25 \text{ E-05}$	$1.53 \pm 0.70 \text{ E-07}$	$3.82 \pm 0.94 \text{ E-07}$	$< 1.0 \text{ E-07}$
SFTCSSED	June 1990	$1.41 \pm 0.74 \text{ E-05}$	$1.94 \pm 0.56 \text{ E-05}$	$1.45 \pm 0.26 \text{ E-05}$	$1.34 \pm 0.22 \text{ E-06}$	$2.61 \pm 0.59 \text{ E-07}$	$< 1.2 \text{ E-07}$
SFCCSED	June 1990	$1.12 \pm 0.67 \text{ E-05}$	$1.23 \pm 0.48 \text{ E-05}$	$1.17 \pm 0.24 \text{ E-05}$	$3.22 \pm 0.99 \text{ E-07}$	$2.88 \pm 0.77 \text{ E-07}$	$8.07 \pm 6.14 \text{ E-08}$
SFBISED	June 1990	$2.53 \pm 0.99 \text{ E-05}$	$1.52 \pm 0.46 \text{ E-05}$	$1.29 \pm 0.20 \text{ E-05}$	$6.83 \pm 4.18 \text{ E-08}$	$1.65 \pm 0.80 \text{ E-07}$	$< 1.0 \text{ E-07}$
SFBCSED	Nov. 1990	$1.12 \pm 0.91 \text{ E-05}$	$1.90 \pm 0.55 \text{ E-05}$	$1.36 \pm 0.21 \text{ E-05}$	$2.47 \pm 2.07 \text{ E-08}$	$3.19 \pm 0.87 \text{ E-07}$	$< 4.7 \text{ E-08}$
SFSDSED	Nov. 1990	$2.19 \pm 0.97 \text{ E-05}$	$2.32 \pm 0.60 \text{ E-05}$	$1.35 \pm 0.21 \text{ E-05}$	$5.07 \pm 0.85 \text{ E-07}$	$1.14 \pm 0.16 \text{ E-06}$	$< 4.3 \text{ E-08}$
SFTCSSED	Nov. 1990	$1.56 \pm 0.77 \text{ E-05}$	$2.02 \pm 0.55 \text{ E-05}$	$1.35 \pm 0.17 \text{ E-05}$	$1.76 \pm 0.20 \text{ E-06}$	$1.18 \pm 0.94 \text{ E-07}$	$< 5.2 \text{ E-08}$
SFCCSED	Nov. 1990	$1.73 \pm 0.82 \text{ E-05}$	$1.92 \pm 0.52 \text{ E-05}$	$1.28 \pm 0.20 \text{ E-05}$	$2.20 \pm 0.47 \text{ E-07}$	$< 1.0 \text{ E-07}$	$< 4.6 \text{ E-08}$
SFBISED	Nov. 1990	$1.09 \pm 0.65 \text{ E-05}$	$1.49 \pm 0.47 \text{ E-05}$	$1.01 \pm 0.16 \text{ E-05}$	$4.65 \pm 2.57 \text{ E-08}$	$2.19 \pm 0.78 \text{ E-07}$	$< 4.2 \text{ E-08}$
		U-234	U-235/236	U-238	Pu-238	Pu-239/240	Am-241
SFBCSED	June 1990	$8.72 \pm 1.93 \text{ E-07}$	$< 5.21 \text{ E-08}$	$9.02 \pm 1.97 \text{ E-07}$	$8.50 \pm 7.20 \text{ E-08}$	$< 2.85 \text{ E-08}$	$9.05 \pm 5.56 \text{ E-08}$
SFTCSSED	June 1990	$6.76 \pm 1.81 \text{ E-07}$	$< 5.90 \text{ E-08}$	$7.74 \pm 1.95 \text{ E-07}$	$< 4.58 \text{ E-08}$	$6.74 \pm 5.76 \text{ E-08}$	$2.15 \pm 0.84 \text{ E-07}$

TABLE C - 1. 10

**1990 Contributions by New York State Low-level Waste Disposal Area (SDA) to Radioactivity
in West Valley Demonstration Project Liquid Effluents (*curies*)**

	<u>TOTALS</u>
Gross Alpha	< 1.3E-06
Gross Beta	9.00±0.4 E-04
H-3	3.70±0.1 E-02
C-14	7.18±2.4 E-05
Sr-90	4.84±0.1 E-04
I-129	< 1.7E-06
Cs-137	< 4.4E-06
U-232	8.29±5.6 E-07
U-234	1.51±0.7E-07
U-235	< 6.7E-08
U-238	1.26±0.6E-07
Pu-238	< 2.7E-08
Pu-239	5.39±4.5E-08
Am-241	1.33±0.8 E-07

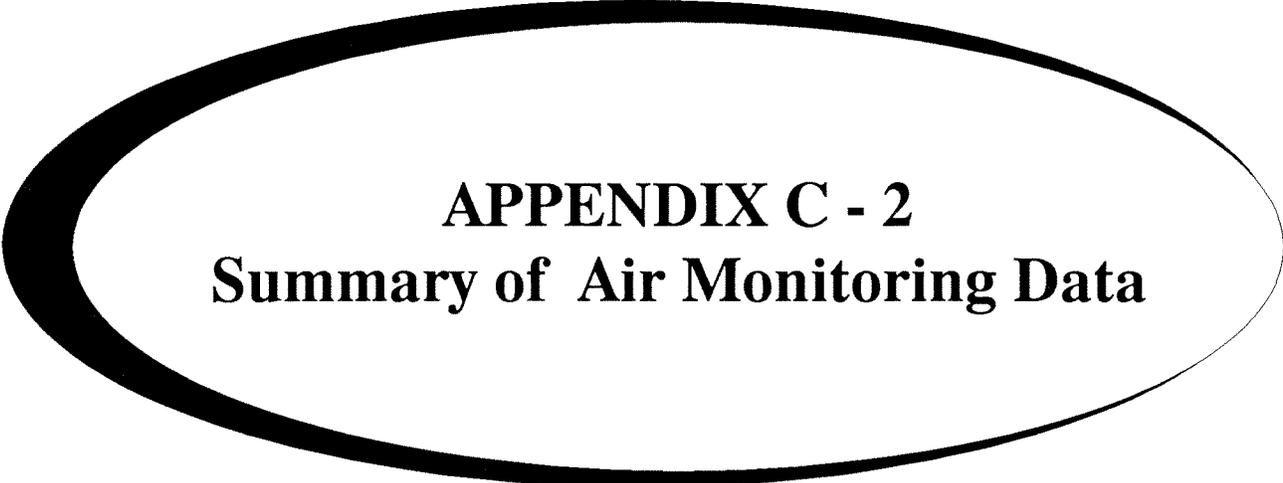
TABLE C - 1. 11

**1990 Radioactivity Concentrations in Surface Soil Samples (in $\mu\text{Ci/g}$ dry weight from upper 15 cm)
Collected at Air Sampling Stations around the WVDP Site**

Location	K-40	Cs-137	Sr-90	Am-241	Pu-239/240
SFFXVRD	1.15 ± 0.18 E-05	8.35 ± 1.29 E-07	4.10 ± 0.80 E-07	1.24 ± 0.64 E-07	<2.35 E-08
SFRSPRD	1.19 ± 0.21 E-05	1.37 ± 0.22 E-06	5.12 ± 0.97 E-07	1.35 ± 0.64 E-07	<2.30 E-08
SFRT240	1.08 ± 0.15 E-05	9.35 ± 1.19 E-07	3.81 ± 0.81 E-07	6.58 ± 4.23 E-08	<3.57 E-08
SFSPRVL	1.36 ± 0.21 E-05	4.26 ± 0.73 E-07	2.96 ± 0.72 E-07	1.57 ± 0.71 E-07	<2.27 E-08
SFTCORD	2.21 ± 0.34 E-05	6.85 ± 3.76 E-08	2.09 ± 0.72 E-07	3.10 ± 1.35 E-07	<2.63 E-08
SFWEVAL	1.29 ± 0.20 E-05	1.60 ± 0.23 E-06	2.87 ± 0.79 E-07	1.16 ± 0.61 E-07	<2.07 E-08
SFGRVAL	9.23 ± 1.64 E-06	<5.1 E-08	5.45 ± 0.92 E-07	7.85 ± 5.32 E-08	<3.11 E-08
SFBOEHN	1.29 ± 0.17 E-05	2.05 ± 0.23 E-06	3.49 ± 0.76 E-07	2.62 ± 0.98 E-07	<2.20 E-08
SFDNKRK	1.42 ± 0.22 E-05	5.71 ± 0.94 E-07	2.70 ± 0.68 E-07	2.07 ± 0.85 E-07	<3.45 E-08
SFLTVAL	1.27 ± 0.21 E-05	2.48 ± 0.55 E-07	1.38 ± 0.69 E-07	1.35 ± 0.74 E-07	<1.46 E-08
	U-234	U-235/236	U-238		
SFRSPRD	7.28 ± 1.72 E-07	6.55 ± 6.38 E-08	6.48 ± 1.61 E-07		
SFGRVAL	9.63 ± 2.06 E-07	<6.28 E-08	7.21 ± 1.74 E-07		
SFBOEHN	7.30 ± 2.23 E-07	<8.35 E-08	8.30 ± 2.23 E-07		



Recording Air Flow at an Environmental Air Sampler



APPENDIX C - 2
Summary of Air Monitoring Data

TABLE C - 2. 1			
1990 Airborne Radioactive Effluent Activity Monthly Totals (curies)			
from Main Ventilation Stack (ANSTACK)			
MONTH	Alpha	Beta	Tritium
January	7.69±4.8 E-08	3.55±0.3 E-06	2.08±0.2E-02
February	7.08±4.8 E-08	4.08±0.3 E-06	1.77±0.2E-02
March	1.27±0.7 E-07	5.49±0.4 E-06	2.22±0.2E-02
April	2.82±0.6 E-07	3.59±0.1 E-05	1.65±0.2E-02
May	1.03±0.5 E-07	4.80±0.3 E-06	1.31±0.1E-02
June	9.23±6.3 E-08	4.73±0.3 E-06	1.28±0.1E-02
July	7.21±1.4 E-07	3.53±0.1 E-05	1.06±0.1E-02
August	1.82±0.6 E-07	7.45±0.7 E-06	8.63±0.9E-03
September	4.47±1.0 E-07	1.53±0.1 E-05	1.06±0.1E-02
October	5.03±1.0 E-07	6.97±0.1 E-05	8.84±0.9E-03
November	5.02±4.1 E-08	1.68±0.1 E-06	8.97±0.9E-03
December	1.31±0.6 E-07	1.93±0.1 E-05	8.91 ± 0.9E03
1990 TOTALS	2.79 ± 0.3E-06	2.07±0.02E-04	1.60±0.1E-01

TABLE C - 2. 2						
1990 Airborne Radioactive Effluent Activity Quarterly Totals (curies)						
from Main Ventilation Stack (ANSTACK)						
QTR	Co-60	Sr-90	I-129	Cs-134	Cs-137	Eu-154
1ST QTR	<1.1 E-07	2.03 ± 0.2 E-06	9.40 ± 0.6 E-06	<6.3 E-08	4.42 ± 0.5 E-06	<7.7 E-08
2ND QTR	<1.2 E-07	9.77 ± 1.0 E-06	2.21 ± 0.1 E-05	<7.9 E-08	9.81 ± 1.0 E-06	<9.5 E-08
3RD QTR	<5.3 E-08	1.63 ± 0.7 E-05	1.32 ± 0.1 E-05	<4.2 E-08	1.95 ± 0.2 E-05	<6.5 E-08
4TH QTR	<4.9 E-08	3.37 ± 0.3 E-05	1.26 ± 0.1 E-05	<4.7 E-08	2.58 ± 0.3 E-05	<6.5 E-08
1990 TOTALS	<1.8 E-07	6.18 ± 0.8 E-05	5.73 ± 0.2 E-05	<1.2 E-07	5.95 ± 0.4 E-05	<1.5 E-07
	U-234	U-235/236	U-238	Pu-238	Pu-239/240	Am-241
1ST QTR	3.74 ± 1.6 E-08	<7.9 E-09	1.75 ± 1.2 E-08	4.05 ± 1.6 E-08	7.35 ± 2.3 E-08	1.42 ± 0.3 E-07
2ND QTR	***	***	Not available	***	***	***
3RD QTR	2.58 ± 0.9 E-08	9.65 ± 6.2 E-09	6.02 ± 5.4 E-09	3.28 ± 0.8 E-07	4.21 ± 1.0 E-07	9.53 ± 1.4 E-07
4TH QTR	2.09 ± 0.8 E-08	1.05 ± 0.6 E-08	6.98 ± 5.5 E-09	2.35 ± 0.6 E-07	2.17 ± 0.5 E-07	5.00 ± 0.7 E-07
1990 TOTALS	8.41 ± 2.0 E-08	2.80 ± 1.2 E-08	3.05 ± 1.4 E-08	6.04 ± 1.0 E-07	7.12 ± 1.1 E-07	1.60 ± 0.2 E-06

TABLE C - 2.3

**Comparison of 1990 Main Stack Exhaust Radioactivity Concentrations
with Department of Energy Guidelines**

ISOTOPE	Half-life	Total μCi Released ^(a)	Avg Conc. ($\mu\text{Ci}/\text{mL}$)	DCG ($\mu\text{Ci}/\text{mL}$)	% of DCG ^(c)
Alpha	N/A	2.79 E+00 (1.03 E+05 Bq)	3.1 E-15	N/A ^(b)	--
Beta	N/A	2.07 E+02 (7.66 E+06 Bq)	2.3 E-13	N/A ^(b)	--
H-3	12.35 yrs	1.60 E+05 (5.92 E+09 Bq)	1.8 E-10 ^(d)	1 E-07	0.2
Co-60	5.27 yrs	<1.8 E-01 (<6.7 E+03 Bq)	<2.0 E-16	8 E-11	<0.1
Sr-90	29.124 yrs	6.18 E+01 (2.29 E+06 Bq)	6.9 E-14	9 E-12	0.8
I-129	1.57 E+07 yrs	5.73 E+01 (2.12 E+06 Bq)	6.4 E-14	7 E-11	<0.1
Cs-134	2.06 yrs	<1.2 E-01 (<4.4 E+03 Bq)	<1.3 E-16	2 E-10	<0.1
Cs-137	30 yrs	5.95 E+01 (2.20 E+06 Bq)	6.7 E-14	4 E-10	<0.1
Eu-154	8.8 yrs	<1.5 E-01 (<5.6 E+03 Bq)	<1.7 E-16	5 E-11	<0.1
U-234 ^(e)	2.45 E+05 yrs	8.41 E-02 (3.11 E+03 Bq)	9.4 E-17	9 E-14	0.1
U-235 ^(e)	7.1 E+08 yrs	2.81 E-02 (1.04 E+03 Bq)	3.2 E-17	1 E-13	<0.1
U-238 ^(e)	4.47 E+09 yrs	3.05 E-02 (1.13 E+03 Bq)	3.4 E-17	1 E-13	<0.1
Pu-238	87.07 yrs	6.04 E-01 (2.23 E+04 Bq)	6.8 E-16	3 E-14	2.3
Pu-239	2.4 E+04 yrs	7.12 E-01 (2.63 E+04 Bq)	8.0 E-16	2 E-14	4.0
Am-241	432 yrs	1.60 E+00 (5.92 E+04 Bq)	1.8 E-15	2 E-14	9.0
					16.7

Notes:

- ^a Total volume released at 60,000 cfm = 8.92E+14 mL/year. μCi values are expressed also in Bq.
- ^b Derived Concentration Guides (DCGs) are not specified for gross alpha or gross beta activity.
- ^c Total percent DCG for applicable measured radionuclides. The percent DCG at the site boundary location with the highest annual average concentration is only 8E-05.
- ^d Tritium reported in pCi/mL = 1.8E-04.
- ^e Total U (μg) = 1.05E+05; average U (pg/mL) = 1.17E-04.

DCGs are listed for reference only. They are applicable to average concentrations at the site boundary but not to stack concentrations, as might be inferred from their inclusion in this table.

TABLE C - 2. 4

**1990 Airborne Radioactive Effluent Activity Monthly Totals (curies)
from the Cement Solidification System Ventilation Stack (ANCSSTK)**

MONTH	Alpha	Beta
January	<5.2E-09	2.43±1.5E-08
February	<4.6E-09	<1.5E-08
March	<6.0E-09	2.28±1.9E-08
April	<5.4E-09	2.61±1.7E-08
May	<5.7E-09	1.23 ± 0.2E-07
June	<7.8E-09	2.74±2.1E-08
July	<5.8E-09	4.87±2.1E-08
August	<5.6E-09	3.40±1.9E-08
September	<5.4E-09	3.07±2.1E-08
October	<4.8E-09	1.55±2.1E-08
November	<3.8E-09	1.57±1.5E-08
December	<4.1E-09	<1.7E-08
1990 TOTALS	<1.9E-08	4.00±0.6E-07

TABLE C - 2. 5

**1990 Airborne Radioactive Effluent Activity Quarterly Totals (curies)
from the Cement Solidification System Ventilation Stack (ANCSSTK)**

QTR	Co-60	Sr-90	I-129	Cs-134	Cs-137	Eu-154
1ST QTR	<2.0 E-08	<1.52 E-09	6.18 ± 1.1 E-08	<1.2 E-08	<1.2 E-08	<1.1 E-08
2ND QTR	<2.1 E-08	2.55 ± 0.5 E-09	<1.2 E-08	<1.4 E-08	<1.9 E-08	<1.1 E-08
3RD QTR	8.44 ± 4.4 E-09	2.58 ± 0.8 E-09	<7.5 E-09	<7.1 E-09	<7.1 E-09	<8.5 E-09
4TH QTR	<1.6 E-08	2.69 ± 1.2 E-09	<9.4 E-09	<8.5 E-09	<1.3 E-08	<6.6 E-09
1990 TOTALS	<3.3 E-08	9.34 ± 2.2 E-09	9.07 ± 2.0 E-08	<2.2 E-08	<2.7 E-08	<1.9 E-08
	U-234	U-235	U-238	Pu-238	Pu-239/240	Am-241
1ST QTR	4.24 ± 2.1 E-09	<1.3 E-09	2.65 ± 1.8 E-09	<8.0 E-10	<6.5 E-10	2.64 ± 1.6 E-09
2ND QTR	***	***	Not available	***	***	***
3RD QTR	1.29 ± 1.1 E-09	<8.8 E-10	<7.8 E-10	1.16 ± 1.0 E-09	<6.8 E-10	1.12 ± 1.0 E-09
4TH QTR	1.46 ± 1.2 E-09	<8.1 E-10	1.10 ± 1.1 E-09	<7.5 E-10	<7.4 E-10	1.76 ± 1.3 E-09
1990 TOTALS	6.99 ± 2.7 E-09	<1.8 E-09	4.53 ± 2.2 E-09	2.71 ± 1.48 E-09	<1.2 E-09	5.52 ± 2.3 E-09

TABLE C - 2. 6		
1990 Airborne Radioactive Effluent Activity Monthly Totals (curies) from the Contact Size Reduction Facility Ventilation Stack (ANCSRFK)		
MONTH	Alpha	Beta
January	<2.5E-09	8.42±6.8 E-09
February	<2.0E-09	7.60±6.8 E-09
March	<3.3E-09	1.44±1.0 E-08
April	<2.7E-09	2.06±1.0 E-08
May	<2.2E-09	1.73±1.0 E-08
June	<5.5E-09	3.20±1.4 E-08
July	<3.1E-09	1.09±0.8 E-08
August	<2.9E-09	<9.8E-09
September	<4.2E-09	4.78±1.6 E-08
October	<3.4E-09	1.36±1.0 E-08
November	<2.7E-09	1.69±1.0 E-08
December	<3.3E-09	2.19±1.2 E-08
1990 TOTALS	<1.1E-08	2.21±0.4E-07

TABLE C - 2. 7						
1990 Airborne Radioactive Effluent Activity Quarterly Totals (curies) from the Contact Size Reduction Facility Ventilation Stack (ANCSRFK)						
QTR	Co-60	Sr-90	I-129	Cs-134	Cs-137	Eu-154
1ST QTR	<1.2 E-08	<9.5 E-10	4.50 ± 0.7 E-08	<1.0 E-08	<1.0 E-08	<6.8 E-09
2ND QTR	<1.0 E-08	3.93 ± 0.5 E-09	<6.5 E-09	<7.1 E-09	<8.8 E-09	<5.9 E-09
3RD QTR	<6.5 E-09	<5.3 E-10	<5.7 E-09	<3.4 E-09	<4.0 E-09	<4.5 E-09
4TH QTR	<6.2 E-09	1.81 ± 0.8 E-09	<5.1 E-09	<4.0 E-09	<4.5 E-08	<3.1 E-09
1990 TOTALS	<1.8 E-08	7.22 ± 1.4 E-09	6.25 ± 1.2 E-08	<1.3 E-08	<1.5 E-08	<1.1 E-08
	U-234	U-235	U-238	Pu-238	Pu-239/240	Am-241
1ST QTR	<9.5 E-10	5.94 ± 5.3 E-10	<9.2 E-10	<5.3 E-10	7.92 ± 6.6 E-10	6.71 ± 5.1 E-10
2ND QTR	***	***	Not available	***	***	***
3RD QTR	<6.7 E-10	<5.3 E-10	8.04 ± 7.2 E-10	<3.8 E-10	<5.4 E-10	6.28 ± 5.2 E-10
4TH QTR	7.95 ± 6.3 E-10	<4.4 E-10	7.95 ± 6.3 E-10	<3.3 E-10	<6.3 E-10	1.17 ± 0.7 E-09
1990 TOTALS	<1.3 E-09	<8.7 E-10	2.52 ± 1.3 E-09	<7.3 E-10	<1.1 E-09	2.47 ± 1.1 E-09

TABLE C - 2. 8		
1990 Airborne Radioactive Effluent Activity Monthly Totals (curies) from the Supernatant Treatment System Ventilation Stack (ANSTSTK)		
MONTH	Alpha	Beta
January	<1.5E-09	6.98±4.6 E-09
February	<1.9E-09	8.78±5.1 E-09
March	<2.7E-09	9.05±6.4 E-09
April	<1.8E-09	6.42±5.6 E-09
May	<1.5E-09	7.91±5.1 E-09
June	<3.1E-09	8.60±7.1 E-09
July	<2.1E-09	6.98±5.6 E-09
August	<1.5E-09	1.40±0.7 E-08
September	<2.1E-09	<7.1E-09
October	<2.0E-09	1.44±0.7 E-08
November	<1.9E-09	1.00±0.6 E-08
December	<1.9E-09	1.01±0.7 E-08
1990 TOTALS	<7.1E-09	1.10±0.2E-07

TABLE C - 2. 9						
1990 Airborne Radioactive Effluent Activity Quarterly Totals (curies) from the Supernatant Treatment System Ventilation System (ANSTSTK)						
QTR	Co-60	Sr-90	I-129	Cs-134	Cs-137	Eu-154
1ST QTR	<5.9 E-09	<6.7 E-10	7.11 ± 0.5 E-07	<4.7 E-09	<4.2 E-09	<4.2 E-09
2ND QTR	<1.1 E-08	7.35 ± 2.5 E-10	7.03 ± 0.4 E-07	<7.2 E-09	<8.3 E-09	<5.3 E-09
3RD QTR	<4.7 E-09	1.75 ± 0.4 E-09	3.46 ± 0.2 E-07	<3.0 E-09	<2.8 E-09	<3.8 E-09
4TH QTR	2.80 ± 2.1 E-09	1.25 ± 0.6 E-09	3.97 ± 0.3 E-07	<2.8 E-09	<3.0 E-09	<3.6 E-09
1990 TOTALS	<1.4 E-08	4.40 ± 1.0 E-09	2.16 ± 0.1 E-06	<9.5 E-09	<1.0 E-08	<8.6 E-09
	U-234	U-235	U-238	Pu-238	Pu-239/240	Am-241
1ST QTR	3.91 ± 2.1 E-09	<1.1 E-09	4.27 ± 2.1 E-09	1.08 ± 0.8 E-09	<6.1 E-10	2.67 ± 1.1 E-09
2ND QTR	***	***	Not available	***	***	***
3RD QTR	8.45 ± 5.5 E-10	<3.0 E-10	<4.5 E-10	<2.2 E-11	<2.2 E-11	<3.1 E-10
4TH QTR	5.16 ± 5.0 E-10	<4.1 E-10	<4.4 E-10	5.63 ± 4.1 E-10	<2.0 E-10	3.31 ± 1.0 E-09
1990 TOTALS	5.27 ± 2.2 E-09	<1.2 E-09	5.16 ± 2.2 E-09	1.67 ± 0.9 E-09	<6.4 E-10	6.29 ± 1.5 E-09

TABLE C - 2.10		
1990 Airborne Radioactive Effluent Activity Monthly Totals (curies) from the Supercompactor Ventilation System (ANSUPCV)		
MONTH	Alpha	Beta
January	< 1.4E-10	2.54±0.6E-09
February	2.66±1.8E-10	1.76±0.4E-09
March	< 2.0E-10	2.68±0.6E-09
April	< 8.1E-11	1.57±0.5E-09
May	< 1.4E-10	1.65±0.5E-09
June	< 1.7E-10	1.65±0.4E-09
July	< 1.4E-10	1.06±0.3E-09
August	< 1.5E-10	2.40±0.5E-09
September	< 1.7E-10	3.00±0.7E-09
October	< 1.9E-10	1.94±0.6E-09
November	< 1.1E-10	1.78±0.5E-09
December	< 1.6E-10	1.45 ±0.6E-09
1990 TOTALS	< 5.4E-10	2.35±0.2E-08

TABLE C - 2.11						
1990 Airborne Radioactive Effluent Activity Quarterly Totals (curies) from the Supercompactor Ventilation System (ANSUPCV)						
QTR	Co-60	Sr-90	Cs-134	Cs-137	Eu-154	
1ST QTR	< 3.0 E-09	7.22 ± 1.7 E-10	< 1.4 E-09	< 2.2 E-09	< 1.2 E-09	
2ND QTR	< 1.9 E-09	1.22 ± 0.1 E-09	< 1.8 E-09	< 1.8 E-09	< 1.2 E-09	
3RD QTR	< 1.0 E-09	< 3.8 E-10	< 6.6 E-10	< 7.1 E-10	< 7.6 E-10	
4TH QTR	< 1.5 E-09	< 1.2 E-10	< 8.0 E-10	< 5.7 E-10	< 6.1 E-10	
1990 TOTALS	< 4.0 E-09	2.44 ± 0.4 E-09	< 2.5 E-09	< 3.0 E-09	< 2.0 E-09	
	U-234	U-235	U-238	Pu-238	Pu-239/240	Am-241
1ST QTR	< 1.1 E-10	< 1.1 E-10	< 1.1 E-10	< 1.5 E-10	< 1.0 E-10	4.27 ± 2.0 E-10
2ND QTR	***	***	Not available	***	***	***
3RD QTR	2.24 ± 1.2 E-10	1.01 ± 1.0 E-10	1.12 ± 1.0 E-10	8.87 ± 6.4 E-11	< 4.5 E-11	< 4.4 E-11
4TH QTR	1.26 ± 1.1 E-10	< 7.3 E-11	< 7.6 E-11	6.32 ± 5.8 E-10	< 3.6 E-10	1.15 ± 0.7 E-10
1990 TOTALS	4.60 ± 2.0 E-10	< 1.6 E-10	< 1.7 E-10	8.71 ± 6.0 E-10	< 3.8 E-10	5.86 ± 2.2 E-10

TABLE C - 2.12				
1990 Radioactivity Concentrations in Airborne Particulates at Fox Valley Air Sampler (AFFXVRD) in $\mu\text{Ci/mL}$				
MONTH	Alpha	Beta	Strontium-90	Cesium-137
JAN	<3.3E-15	2.77±0.4E-14		
FEB	3.80±1.1E-15	2.51±0.4E-14		
MAR	1.20±1.1E-15	2.20±0.4E-14		
1st Qtr			<1.49E-16	<6.01E-16
APR	1.89±1.3E-15	2.33±0.4E-14		
MAY	8.62±7.4E-16	3.50±0.9E-14		
JUN	<8.4E-16	1.67±0.3E-14		
2nd Qtr			4.88±2.6E-17	<6.52E-16
JUL	<9.5E-16	1.34±0.4E-14		
AUG	<7.1E-16	2.02±0.4E-14		
SEP	9.72±8.7E-16	2.03±0.4E-14		
3rd Qtr			9.70 ± 1.2E-16	<2.80E-16
OCT	<8.7E-16	1.62±0.4E-14		
NOV	1.35±1.0E-15	2.11±0.4E-14		
DEC	9.45±7.6E-16	1.77±0.3E-14		
4th Qtr			2.12 ± 0.5E-16	<2.27E-16

TABLE C - 2.13					
1990 Radioactivity Concentrations in Airborne Particulates at Rock Springs Road Sampler (AFRSPRD) in $\mu\text{Ci/mL}$					
MONTH	Alpha	Beta	Strontium-90	Iodine-129	Cesium-137
JAN	<5.2E-16	1.87±0.3E-14			
FEB	7.40±7.2E-16	1.69±0.3E-14			
MAR	8.08±7.6E-16	1.56±0.3E-14			
1st Qtr			4.01±0.8E-16	<3.94E-16	<5.56E-16
APR	7.06±6.4E-16	1.71±0.3E-14			
MAY	8.25±6.7E-16	9.26±0.2E-15			
JUN	<7.0E-16	1.30±0.3E-14			
2nd Qtr			4.81±2.0E-17	Not available	4.98 ± 3.6E-16
JUL	<6.8E-16	1.65±0.3E-14			
AUG	<5.9E-16	1.43±0.3E-14			
SEP	5.79 ± 5.6E-16	1.59±0.3E-14			
3rd Qtr			5.74 ± 3.9E-17	<3.63E-16	<1.98E-16
OCT	<6.4E-16	1.57±0.3E-14			
NOV	1.10±0.9E-15	2.43±0.4E-14			
DEC	1.04±0.8E-15	1.78±0.3E-14			
4th Qtr			1.60 ± 0.5E-16	<2.96E-16	<2.96E-16

TABLE C - 2.14

**1990 Radioactivity Concentrations in Airborne Particulates
at Route 240 Air Sampler (AFRT240) in $\mu\text{Ci/mL}$**

MONTH	Alpha	Beta	Strontium-90	Cesium-137
JAN	$8.04 \pm 7.9\text{E-}16$	$2.05 \pm 0.3\text{E-}14$		
FEB	$< 6.9\text{E-}16$	$1.96 \pm 0.3\text{E-}14$		
MAR	$< 6.9\text{E-}16$	$1.75 \pm 0.3\text{E-}14$		
1st Qtr			$< 1.20\text{E-}16$	$< 5.67\text{E-}16$
APR	$1.15 \pm 1.0\text{E-}15$	$1.79 \pm 0.3\text{E-}14$		
MAY	$< 7.4\text{E-}16$	$1.25 \pm 0.3\text{E-}14$		
JUN	$< 9.2\text{E-}16$	$1.90 \pm 0.4\text{E-}14$		
2nd Qtr			$4.51 \pm 2.4\text{E-}17$	$< 6.02\text{E-}16$
JUL	$< 1.0\text{E-}15$	$2.18 \pm 0.4\text{E-}14$		
AUG	$9.49 \pm 9.2\text{E-}16$	$1.87 \pm 0.4\text{E-}14$		
SEP	$1.18 \pm 1.0\text{E-}15$	$2.16 \pm 0.4\text{E-}14$		
3rd Qtr			$3.20 \pm 0.6\text{E-}16$	$< 2.91\text{E-}16$
OCT	$< 8.7\text{E-}16$	$1.64 \pm 0.4\text{E-}14$		
NOV	$1.02 \pm 0.9\text{E-}15$	$2.59 \pm 0.4\text{E-}14$		
DEC	$< 7.1\text{E-}16$	$1.76 \pm 0.3\text{E-}14$		
4th Qtr			$2.56 \pm 0.6\text{E-}16$	$< 3.35\text{E-}16$

TABLE C - 2.15

**1990 Radioactivity Concentrations in Airborne Particulates
at Springville Air Sampler (AFSPRVL) in $\mu\text{Ci/mL}$**

MONTH	Alpha	Beta	Strontium-90	Cesium-137
JAN	$1.40 \pm 1.2\text{E-}15$	$3.75 \pm 0.6\text{E-}14$		
FEB	$8.74 \pm 8.1\text{E-}16$	$1.75 \pm 0.3\text{E-}14$		
MAR	$9.70 \pm 8.7\text{E-}16$	$1.58 \pm 0.3\text{E-}14$		
1st Qtr			$< 1.20\text{E-}16$	$< 8.40\text{E-}16$
APR	$1.19 \pm 0.9\text{E-}15$	$1.70 \pm 0.3\text{E-}14$		
MAY	$6.82 \pm 6.3\text{E-}16$	$8.84 \pm 2.3\text{E-}15$		
JUN	$< 6.2\text{E-}16$	$1.04 \pm 0.2\text{E-}14$		
2nd Qtr			$3.68 \pm 1.4\text{E-}17$	$< 6.83\text{E-}16$
JUL	$< 6.4\text{E-}16$	$1.36 \pm 0.3\text{E-}14$		
AUG	$6.72 \pm 5.6\text{E-}16$	$1.50 \pm 0.3\text{E-}14$		
SEP	$6.52 \pm 5.3\text{E-}16$	$1.63 \pm 0.3\text{E-}14$		
3rd Qtr			$< 3.65\text{E-}17$	$< 1.67\text{E-}16$
OCT	$< 6.7\text{E-}16$	$1.50 \pm 0.3\text{E-}14$		
NOV	$1.34 \pm 0.9\text{E-}15$	$2.09 \pm 0.3\text{E-}14$		
DEC	$1.11 \pm 0.8\text{E-}15$	$1.93 \pm 0.3\text{E-}14$		
4th Qtr			$7.35 \pm 4.0\text{E-}17$	$4.44 \pm 2.6\text{E-}16$

TABLE C - 2.16				
1990 Radioactivity Concentrations in Airborne Particulates at Thomas Corners Road Air Sampler (AFTCORD) in $\mu\text{Ci/mL}$				
MONTH	Alpha	Beta	Strontium-90	Cesium-137
JAN	8.81±6.8E-16	1.84±0.3E-14		
FEB	8.75±6.7E-16	1.59±0.3E-14		
MAR	8.09±7.1E-16	1.46±0.3E-14		
1st Qtr			<9.30E-17	<6.69E-16
APR	9.31±7.9E-16	1.33±0.3E-14		
MAY	6.70±4.4E-16	1.12±0.2E-14		
JUN	<6.5E-16	1.26±0.3E-14		
2nd Qtr			4.41±1.5E-17	<3.98E-16
JUL	<7.3E-16	1.36±0.3E-14		
AUG	7.25±7.2E-16	1.48±0.3E-14		
SEP	9.29±8.4E-16	1.98±0.4E-14		
3rd Qtr			1.82 ± 0.5E-16	<2.27E-16
OCT	<8.3E-16	1.89±0.4E-14		
NOV	8.51±8.5E-16	2.33±0.4E-14		
DEC	7.79±7.6E-16	1.85±0.3E-14		
4th Qtr			1.18 ± 0.4E-16	<2.32E-16

TABLE C - 2.17				
1990 Radioactivity Concentrations in Airborne Particulates at West Valley Air Sampler (AFWEVAL) in $\mu\text{Ci/mL}$				
MONTH	Alpha	Beta	Strontium-90	Cesium-137
JAN	9.62±0.1E-16	2.75±0.5E-14		
FEB	1.45±1.1E-15	2.60±0.5E-14		
MAR	1.41±1.2E-15	2.39±0.4E-14		
1st Qtr			<1.60E-16	<6.50E-16
APR	1.33±1.1E-15	2.40±0.4E-14		
MAY	8.20±7.5E-16	1.09±0.3E-14		
JUN	<7.6E-16	1.58±0.3E-14		
2nd Qtr			9.57±3.3E-17	<9.62E-16
JUL	<8.5E-16	1.61±0.3E-14		
AUG	8.20±7.3E-16	2.07±0.3E-14		
SEP	1.09±0.8E-15	2.63±0.4E-14		
3rd Qtr			1.13 ± 0.5E-16	<2.14E-16
OCT	<7.7E-16	1.95±0.4E-14		
NOV	1.40±1.0E-15	2.49±0.4E-14		
DEC	1.04±0.9E-15	2.34±0.4E-14		
4th Qtr			1.28 ± 0.5E-16	<2.99E-16

TABLE C - 2.18

1990 Radioactivity Concentrations in Airborne Particulates at Great Valley Air Sampler (AFGRVAL) in $\mu\text{Ci/mL}$					
MONTH	Alpha	Beta	Strontium-90	Iodine-129	Cesium-137
JAN	1.39±0.9E-15	1.83±0.3E-14			
FEB	1.04±0.8E-15	1.80±0.3E-14			
MAR	1.12±0.9E-15	1.63±0.3E-14			
1st Qtr			1.63±0.6E-16	<4.08E-16	5.18±3.3E-16
APR	1.17±0.9E-15	1.67±0.3E-14			
MAY	<6.3E-16	1.04±0.3E-14			
JUN	<8.3E-16	2.00±0.3E-14			
2nd Qtr			<3.37E-17	<3.01E-16	<6.74E-16
JUL	<6.2E-16	1.27±0.2E-14			
AUG	<9.5E-16	1.61±0.6E-14			
SEP	9.00±6.9E-16	1.35±0.3E-14			
3rd Qtr			<4.81E-17	<2.42E-16	<2.05E-16
OCT	<7.4E-16	1.43±0.3E-14			
NOV	9.75±9.5E-16	2.23±0.4E-14			
DEC	1.29±1.0E-15	1.94±0.4E-14			
4th Qtr			1.38 ± 0.5E-16	<3.79E-16	<2.20E-16

TABLE C - 2.19

1990 Radioactivity Concentrations in Airborne Particulates at Dunkirk Air Sampler (AFDNKRK) in $\mu\text{Ci/mL}$				
MONTH	Alpha	Beta	Strontium-90	Cesium-137
JAN	8.84±7.8E-16	2.05±0.3E-14		
FEB	<7.6E-16	1.93±0.4E-14		
MAR	9.83±9.0E-16	1.66±0.3E-14		
1st Qtr			<1.24E-16	<5.19E-16
APR	1.20±0.9E-15	1.69±0.3E-14		
MAY	<6.2E-16	1.04±0.3E-14		
JUN	<7.7E-16	1.30±0.3E-14		
2nd Qtr			3.68±1.9E-17	<4.82E-16
JUL	<8.1E-16	1.83±0.3E-14		
AUG	8.51±7.1E-16	1.56±0.3E-14		
SEP	1.17±0.8E-15	1.72±0.3E-14		
3rd Qtr			<4.44E-17	<2.03E-16
OCT	<7.6E-16	1.70±0.3E-14		
NOV	1.24±1.2E-15	2.67±0.4E-14		
DEC	1.42±1.1E-15	2.27±0.4E-14		
4th Qtr			1.65 ± 0.5E-16	<5.89E-16

TABLE C - 2.20

1990 Radioactivity Concentrations in Airborne Particulates
at Dutch Hill Air Sampler (AFBOEHN) in $\mu\text{Ci/mL}$

MONTH	Alpha	Beta	Strontium-90	Cesium-137
JAN	<6.5E-16	1.78±0.3E-14		
FEB	<7.4E-16	1.61±0.3E-14		
MAR	1.07 ± 0.8E-15	1.66±0.3E-14		
1st Qtr			< 1.14E-16	< 7.43E-16
APR	1.13±0.9E-15	1.88±0.3E-14		
MAY	1.13±0.9E-15	1.29±0.3E-14		
JUN	<1.6E-15	1.63±0.4E-14		
2nd Qtr			<4.65E-17	<4.65E-16
JUL	<1.1E-15	2.54±0.5E-14		
AUG	<1.2E-15	2.35±0.5E-14		
SEP	<1.2E-15	2.57±0.5E-14		
3rd Qtr			1.97 ± 0.7E-16	< 3.44E-16
OCT	<1.5E-15	2.59±0.6E-14		
NOV	1.38±1.1E-15	2.31±0.4E-14		
DEC	<8.9E-16	2.19±0.4E-14		
4th Qtr			7.31 ± 6.0E-17	<3.87E-16

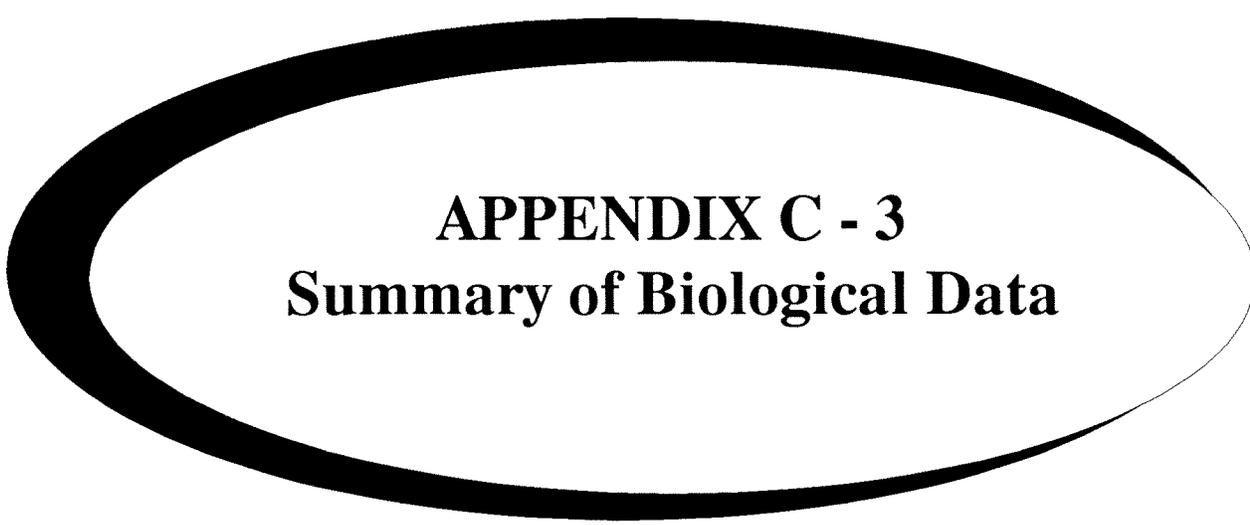
TABLE C - 2. 21

Radioactivity in Fallout During 1990 (nCi/m²/mo)

<i>Dutch Hill (AFDHFOP)</i>				<i>Fox Valley Road (AFFXFOP)</i>			
MONTH	Gross Alpha	Gross Beta	H-3	MONTH	Gross Alpha	Gross Beta	H-3
			(μ Ci/mL)				(μ Ci/mL)
JAN	2.1 E-02	1.5 E-01	<1.0 E-07	JAN	6.1 E-02	4.3 E-01	<1.0 E-07
FEB	4.6 E-02	3.0 E-01	<1.0 E-07	FEB	1.1 E-01	4.3 E-01	1.77 \pm 1.2 E-07
MAR	2.5 E-02	1.2 E-01	<1.0 E-07	MAR	6.2 E-02	2.0 E-01	<1.0 E-07
APR	4.0 E-02	2.2 E-01	<1.0 E-07	APR	4.9 E-02	2.6 E-01	<1.0 E-07
MAY	5.0 E-02	4.0 E-01	<1.0 E-07	MAY	9.1 E-02	5.5 E-01	<1.0 E-07
JUN	3.1 E-02	2.2 E-01	<1.0 E-07	JUN	3.6 E-02	2.0 E-01	<1.0 E-07
JUL	8.3 E-02	3.4 E-01	<1.0 E-07	JUL	8.4 E-02	3.2 E-01	<1.0 E-07
AUG	3.9 E-03	6.1 E-01	<1.0 E-07	AUG	2.8 E-02	2.2 E-01	<1.0 E-07
SEP	7.1 E-02	3.2 E-01	<1.0 E-07	SEP	2.6 E-02	3.0 E-01	<1.0 E-07
OCT	9.8 E-02	1.6 E+00	9.70 \pm 1.3 E-07	OCT	1.0 E-01	5.5 E-01	<1.0 E-07
NOV	2.5 E-02	3.0 E-01	<1.0 E-07	NOV	5.4 E-02	5.3 E-01	<1.0 E-07
DEC	2.4 E-02	2.1 E-01	<1.0 E-07	DEC	3.7 E-02	4.1 E-01	<1.0 E-07
<i>Route 240 (AF24FOP)</i>				<i>Thomas Corners Road (AFTCFOP)</i>			
MONTH	Gross Alpha	Gross Beta	H-3	MONTH	Gross Alpha	Gross Beta	H-3
			(μ Ci/mL)				(μ Ci/mL)
JAN	2.4 E-02	3.1 E-01	<1.0 E-07	JAN	6.4 E-02	4.1 E-01	<1.0 E-07
FEB	5.7 E-02	3.3 E-01	<1.0 E-07	FEB	6.4 E-02	3.4 E-01	<1.0 E-07
MAR	3.7 E-02	1.5 E-01	<1.0 E-07	MAR	3.7 E-02	1.9 E-01	<1.0 E-07
APR	2.8 E-02	2.5 E-01	<1.0 E-07	APR	5.6 E-02	3.2 E-01	<1.0 E-07
MAY	1.2 E-01	6.1 E-01	<1.0 E-07	MAY	6.5 E-02	4.9 E-01	<1.0 E-07
JUN	3.9 E-02	3.8 E-01	SAMPLE DRY	JUN	3.0 E-02	1.5 E-01	SAMPLE DRY
JUL	1.4 E-01	5.9 E-01	<1.0 E-07	JUL	7.3 E-02	3.2 E-01	<1.0 E-07
AUG	1.0 E-02	7.8 E-02	<1.0 E-07	AUG	9.6 E-03	4.9 E-02	<1.0 E-07
SEP	3.5 E-02	5.2 E-02	<1.0 E-07	SEP	4.6 E-02	5.4 E-01	<1.0 E-07
OCT	3.8 E-02	9.7 E-01	<1.0 E-07	OCT	3.9 E-02	5.1 E-01	3.91 \pm 1.2 E-07
NOV	1.7 E-02	3.2 E-01	<1.0 E-07	NOV	1.8 E-02	3.1 E-01	2.67 \pm 1.3 E-07
DEC	4.0 E-02	3.0 E-01	<1.0 E-07	DEC	5.5 E-02	3.4 E-01	<1.0 E-07
<i>Rain Gage (ANRGFOP)</i>							
MONTH	Gross Alpha	Gross Beta	H-3				
			(μ Ci/mL)				
JUN	<2.7 E-02	2.4 E-01	1.44 \pm 1.2 E-07				
JUL	<1.1 E-02	1.4 E-01	<1.0 E-07				
AUG	9.0 E-03	1.1 E-01	<1.0 E-07				
SEP	3.8 E-02	4.8 E-01	<1.0 E-07				
OCT	6.3 E-02	4.1 E-01	3.17 \pm 1.2 E-07				
NOV	4.2 E-02	3.5 E-01	<1.0 E-07				
DEC	7.5 E-02	4.3 E-01	<1.0 E-07				



It is preferred that you take a milk sample only.



APPENDIX C - 3
Summary of Biological Data

TABLE C - 3.1

Radioactivity Concentrations ($\mu\text{Ci/mL}$) in Milk - 1990

LOCATION	H-3	Sr-90	I-129	Cs-134	Cs-137
NNW FARM (BFMREED) 1st Qtr 1990	<2.2 E-07	2.71 \pm 0.35 E-09	<9.9 E-10	<7.90 E-09	<9.39 E-09
WNW FARM (BFMCOBO) 1st Qtr 1990	<2.2 E-07	1.40 \pm 0.23 E-09	<9.9 E-10	<8.89 E-09	<8.55 E-09
CONTROL (BFMCTLS) 1st Qtr 1990	<2.2 E-07	3.00 \pm 0.37 E-09	<9.9 E-10	<8.64 E-09	<8.85 E-09
CONTROL (BFMCTLN) 1st Qtr 1990	4.63 \pm 1.52 E-07	<2.0 E-09	<9.9 E-10	<7.59 E-09	<7.68 E-09
NNW FARM (BFMREED) 2nd Qtr 1990	<2.1 E-07	3.31 \pm 1.79 E-10	<9.6 E-10	<9.4 E-09	<9.5 E-09
WNW FARM (BFMCOBO) 2nd Qtr 1990	3.85 \pm 1.38 E-07	1.57 \pm 0.24 E-09	<9.6 E-10	<7.0 E-09	1.50 \pm 0.56 E-08
CONTROL (BFMCTLS) 2nd Qtr 1990	<2.1 E-07	1.60 \pm 0.26 E-09	<9.6 E-10	<7.6 E-09	<1.1 E-08
CONTROL (BFMCTLN) 2nd Qtr 1990	1.65 \pm 0.24 E-06	9.17 \pm 2.49 E-10	<9.6 E-10	<1.0 E-08	<1.3 E-08
NNW FARM (BFMREED) 3rd Qtr 1990	<1.22 E-07	1.72 \pm 0.29 E-09	<4.85 E-10	<1.2 E-08	<1.8 E-08
WNW FARM (BFMCOBO) 3rd Qtr 1990	<1.24 E-07	4.11 \pm 0.49 E-09	<4.90 E-10	<6.2 E-09	<6.8 E-09
CONTROL (BFMCTLS) 3rd Qtr 1990	<1.26 E-07	2.51 \pm 0.38 E-09	<4.84 E-10	<1.2 E-08	<1.9 E-08
CONTROL (BFMCTLN) 3rd Qtr 1990	1.61 \pm 1.28 E-07	9.92 \pm 2.72 E-10	<4.92 E-10	<5.8 E-09	<4.8 E-09
NNW FARM (BFMREED) 4th Qtr 1990	1.7 \pm 0.27 E-06	1.87 \pm 0.29 E-09	<5.24 E-10	<1.0 E-08	1.12 \pm 0.99 E-08
WNW FARM (BFMCOBO) 4th Qtr 1990	3.82 \pm 0.45 E-06	3.12 \pm 0.40 E-09	<5.17 E-10	<3.1 E-09	<8.1 E-09
CONTROL (BFMCTLS) 4th Qtr 1990	3.76 \pm 1.78 E-07	1.99 \pm 0.32 E-09	<5.19 E-10	<8.7 E-09	<1.5 E-08
CONTROL (BFMCTLN) 4th Qtr 1990	2.60 \pm 1.73 E-07	1.79 \pm 0.30 E-09	<5.15 E-10	<6.0 E-09	<7.0 E-09
SE FARM (BFMWIDR) October 1990	2.33 \pm 1.74 E-07	5.98 \pm 0.68 E-09	<5.89 E-10	<1.1 E-08	<1.7 E-08
SSW FARM (BFMHAUR) November 1990	<1.69 E-07	4.97 \pm 0.60 E-09	<5.69 E-10	<5.2 E-09	<7.5 E-09

TABLE C - 3.2

Radioactivity Concentrations in Meat ($\mu\text{Ci/g Dry}$) - 1990

Location	% MOISTURE	SR-90	Cs-134	CS-137	K-40
DEER FLESH - NEAR SITE (BFDNEAR #1)	***	2.95±1.29E-09	<1.4E-07	<1.8E-07	7.84 ± 2.62E-06
DEER FLESH - NEAR SITE (BFDNEAR #2)	65.7	8.57±1.50E-09	<9.3E-08	2.30±0.93E-07	7.00 ± 2.01E-06
DEER FLESH - NEAR SITE (BFDNEAR #3)	67.1	N/A	<1.1E-07	<9.9E-08	2.28 ± 0.41E-05
DEER FLESH - BACKGROUND (BFDCTRL #1)	79.0	1.46±0.77E-09	<7.5E-08	<1.3E-07	1.06 ± 0.28E-05
DEER FLESH - BACKGROUND (BFDCTRL #2)	74.8	3.76 ± 2.05E-09	8.7E-08	2.83 ± 0.95E-07	1.21 ± 0.27E-05
DEER FLESH - BACKGROUND (BFDCTRL #3)	72.5	1.72±0.77E-09	<8.1E-08	<1.1E-07	9.89 ± 2.32E-06
BEEF FLESH - BACKGROUND (BFBCTRL)6/90	77.3	1.23 ± 0.23 E-08	<2.6 E-08	<2.8 E-8	1.23 ± 0.15 E-05
BEEF FLESH - NEAR SITE (BFBNEAR)6/90	75.5	4.27 ± 0.49 E-08	<5.2 E-08	<5.3 E-8	8.99 ± 1.33 E-06
BEEF FLESH - BACKGROUND (BFBCTRL)10/90	72.5	5.55±2.05E-09	<2.3E-08	<2.6E-08	9.52 ± 1.64E-06
BEEF FLESH - NEAR SITE (BFBNEAR)10/90	69.8	<1.55E-09	<1.0E-08	<2.7E-08	1.11± 0.16E-05

* N/A Not available

TABLE C - 3.3

Radioactivity Concentrations in Food Crops ($\mu\text{Ci/g Dry}$) - 1990

LOCATION	% Moisture	H-3 ($\mu\text{Ci/mL}$)	Sr-90	K-40	Co-60	Cs-137
BEANS - NEAR-SITE (BFVNEAR)	76.34	<8.69 E-07	8.38 ± 0.87 E-08	2.56 ± 0.43 E-05	<1.8 E-07	<1.5 E-07
BEANS - BACKGROUND (BFVCTRL)	92.27	<8.88 E-07	7.70 ± 0.82 E-08	3.10 ± 0.55 E-05	<1.4 E-07	<7.1 E-08
APPLES - NEAR-SITE (BNVNEAR)	85.87	<8.81 E-07	6.14 ± 0.70 E-08	8.24 ± 1.87 E-06	<1.0 E-07	<8.0 E-08
APPLES - BACKGROUND (BFVCTRL)	85.24	2.10 ± 1.09 E-06	1.35 ± 0.20 E-08	8.70 ± 1.73 E-06	<6.9 E-08	<2.8 E-08
CORN - NEAR-SITE (BFVNEAR)	54.26	<8.36 E-07	2.66 ± 1.26 E-09	5.20 ± 1.19 E-06	<7.1 E-08	<3.8 E-08
CORN - BACKGROUND (BFVCTRL)	78.74	<8.71 E-07	5.77 ± 1.35 E-09	1.46 ± 0.26 E-05	<8.2 E-08	<5.1 E-08
HAY - NEAR-SITE (BFHNEAR)	14.52	1.28 ± 0.96 E-06	5.49 ± 0.62 E-08	1.06 ± 0.30 E-05	<1.9 E-07	<2.8 E-07
HAY - BACKGROUND (BFHCTLS)	12.64	9.46 ± 8.74 E-07	6.71 ± 0.73 E-08	7.03 ± 1.95 E-06	<1.4 E-07	<1.2 E-07

TABLE C - 3.4

Radioactivity Concentrations in Fish Flesh from Cattaraugus Creek (μ Ci/g dry) - 1990

Cattaraugus Creek (BFFCATC) above Springville Dam

	1st Half 1990			2nd Half 1990		
	Sr-90	Cs-134	Cs-137	Sr-90	Cs-134	Cs-137
<i>Average</i>	N/A	<5.1 E-08	<6.1 E-08	N/A	N/A	N/A
<i>Median</i>	N/A	N/A	N/A	1.80E-08	<2.22E-07	<2.11E-07
<i>Geometric Deviation (Avg)</i>	N/A	N/A	N/A	1.64	1.68	1.52
<i>Maximum</i>	N/A	N/A	N/A	7.12±2.2E-08	<5.2E-07	<4.3E-07
<i>Minimum</i>	N/A	N/A	N/A	<1.40E-08	<8.8E-08	<8.7E-08
<i>Moisture (Average %)</i>	76.3			78.2		

Cattaraugus Creek (BFFCTRL) Background

	1st Half 1990			2nd Half 1990		
	Sr-90	Cs-134	Cs-137	Sr-90	Cs-134	Cs-137
<i>Average</i>	1.59 ± 0.52 E-08	N/A	N/A	N/A	N/A	N/A
<i>Median</i>	N/A	N/A	N/A	1.92E-08	<2.68E-07	<2.56E-07
<i>Geometric Deviation (Avg)</i>	N/A	N/A	N/A	2.02	1.82	1.88
<i>Maximum</i>	N/A	N/A	N/A	5.73±2.2E-08	<5.7E-07	<5.0E-07
<i>Minimum</i>	N/A	N/A	N/A	7.00±6.0E-09	<1.3E-07	<1.3E-07
<i>Moisture (Average %)</i>	82.1			77.6		

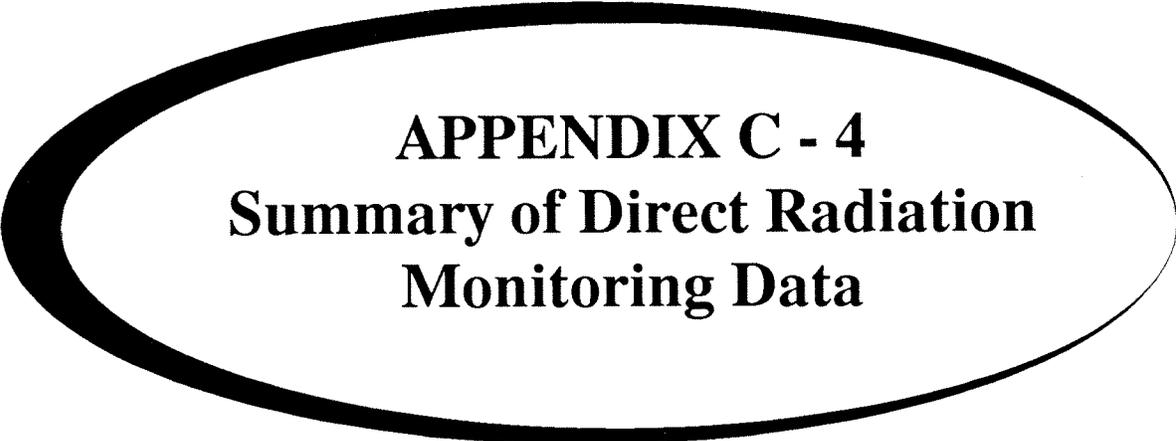
Cattaraugus Creek (BFFCATD) below Springville Dam

	1st Half 1990			2nd Half 1990		
	Sr-90	Cs-134	Cs-137	Sr-90	Cs-134	Cs-137
<i>Average</i>	6.22 ± 0.86 E-08	<4.1 E-08	<4.5 E-08	1.05 E-08	<6.75 E-08	<9.00 E-08
<i>Median</i>	N/A	N/A	N/A	3.80	1.17	1.21
<i>Geometric Deviation (Avg)</i>	N/A	N/A	N/A	2.45 E-07	<9.5 E-08	<1.1 E-07
<i>Maximum</i>	N/A	N/A	N/A	5.32 E-09	<6.2 E-08	5.68 E-08
<i>Minimum</i>	N/A	N/A	N/A	77.8		
<i>Moisture (Average %)</i>	82.4					

N/A Not available



Exchanging an Environmental TLD Package



APPENDIX C - 4
Summary of Direct Radiation
Monitoring Data

Table C- 4.1

Summary of Quarterly Averages of TLD Measurements for 1990 (Roentgen \pm 3 SD/Quarter)

Location No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Location Av.
1	.016 \pm .004	.021 \pm .003	.022 \pm .003	.021 \pm .002	.020 \pm .003
2	.021 \pm .024	.020 \pm .003	.022 \pm .004	.022 \pm .008	.021 \pm .010
3	.017 \pm .017	.020 \pm .002	.021 \pm .004	.020 \pm .003	.019 \pm .006
4	.015 \pm .006	.019 \pm .003	.021 \pm .004	.020 \pm .003	.019 \pm .004
5	.017 \pm .007	.020 \pm .002	.023 \pm .004	.021 \pm .003	.020 \pm .004
6	.015 \pm .003	.019 \pm .002	.021 \pm .003	.020 \pm .005	.019 \pm .003
7	.016 \pm .009	.018 \pm .003	.020 \pm .003	.019 \pm .002	.018 \pm .004
8	.018 \pm .011	.019 \pm .003	.022 \pm .003	.019 \pm .002	.019 \pm .005
9	.013 \pm .004	.018 \pm .002	.020 \pm .004	.019 \pm .002	.018 \pm .003
10	.015 \pm .005	.020 \pm .002	.022 \pm .002	.019 \pm .004	.019 \pm .003
11	.017 \pm .002	.022 \pm .004	.024 \pm .005	.022 \pm .002	.021 \pm .003
12	.022 \pm .039	.019 \pm .003	.023 \pm .004	.021 \pm .003	.021 \pm .012
13	.017 \pm .004	.021 \pm .002	.026 \pm .002	.022 \pm .004	.021 \pm .003
14	.017 \pm .002	.022 \pm .003	.024 \pm .004	.020 \pm .003	.021 \pm .003
15	.015 \pm .006	.020 \pm .002	.022 \pm .002	.020 \pm .003	.019 \pm .003
16	.016 \pm .003	.021 \pm .006	.023 \pm .002	.022 \pm .002	.020 \pm .003
17	.015 \pm .003	.020 \pm .003	.023 \pm .006	.020 \pm .004	.020 \pm .004
18**	.034 \pm .009	.041 \pm .005	.045 \pm .003	.045 \pm .005	.041 \pm .005
19**	.020 \pm .002	.024 \pm .002	.027 \pm .003	.024 \pm .002	.024 \pm .003
20	.017 \pm .013	.020 \pm .002	.022 \pm .004	.021 \pm .003	.020 \pm .005
21	.015 \pm .003	.020 \pm .002	.021 \pm .002	.019 \pm .002	.018 \pm .002
22	.019 \pm .026	.019 \pm .003	.021 \pm .004	.019 \pm .003	.020 \pm .009
23	.015 \pm .006	.018 \pm .004	.020 \pm .003	.018 \pm .002	.018 \pm .004
24**	1.405 \pm .331	1.387 \pm .107	1.366 \pm .125	1.345 \pm .227	1.376 \pm .197
25	.034 \pm .014	.035 \pm .004	.038 \pm .007	.033 \pm .005	.035 \pm .008
26	.030 \pm .012	.031 \pm .003	.034 \pm .004	.033 \pm .005	.032 \pm .006
27	.017 \pm .003	.022 \pm .001	.024 \pm .002	.023 \pm .004	.022 \pm .002
28	.018 \pm .006	.022 \pm .002	.025 \pm .004	.023 \pm .004	.022 \pm .004
29	.023 \pm .005	.025 \pm .005	.029 \pm .004	.025 \pm .005	.025 \pm .005
30	.025 \pm .004	.032 \pm .005	.034 \pm .002	.031 \pm .002	.031 \pm .003
31	.016 \pm .005	.020 \pm .002	.023 \pm .001	.021 \pm .002	.020 \pm .003
32	.025 \pm .003	.028 \pm .003	.034 \pm .007	.030 \pm .004	.029 \pm .004
33	.030 \pm .009	.035 \pm .002	.041 \pm .007	.039 \pm .005	.036 \pm .006
34	.050 \pm .012	.055 \pm .010	.059 \pm .015	.057 \pm .003	.055 \pm .010
35	.052 \pm .012	.053 \pm .005	.070 \pm .013	.074 \pm .010	.062 \pm .010
36	.055 \pm .005	.065 \pm .008	.069 \pm .007	.068 \pm .015	.064 \pm .009
37	.015 \pm .003	.018 \pm .004	.020 \pm .003	.018 \pm .002	.018 \pm .003
38**	.042 \pm .005	.046 \pm .003	.049 \pm .007	.046 \pm .006	.046 \pm .005
39**	.082 \pm .008	.087 \pm .008	.088 \pm .012	.093 \pm .020	.088 \pm .012
40**	.201 \pm .050	.221 \pm .022	.215 \pm .088	.231 \pm .024	.217 \pm .046
41	.013 \pm .003	.017 \pm .003	.020 \pm .002	.019 \pm .005	.017 \pm .003
Quarterly Average**	.021 \pm .008	.025 \pm .003	.028 \pm .004	.026 \pm .004	.025 \pm .005

Locations shown on Figures A-3 and A-6.

** TLDs 18, 19, 24, 38, 39, and 40 are not included in the quarterly averages.

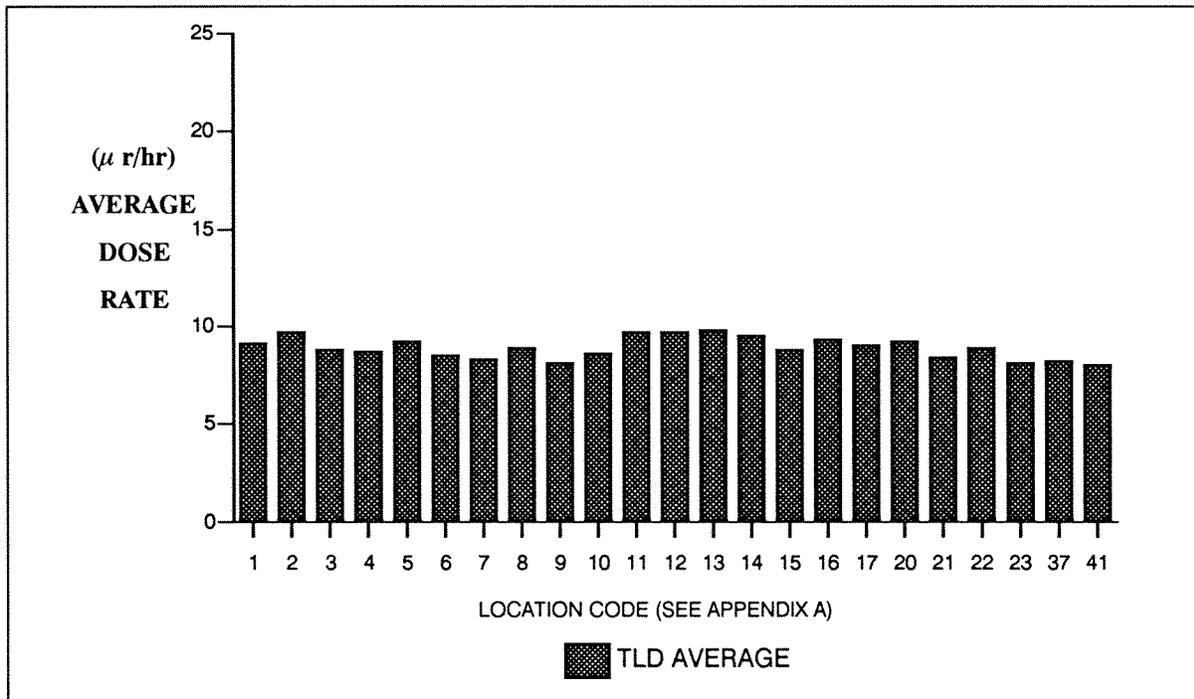


Figure C - 4.1

1990 Average Quarterly Gamma Exposure Rates Around the West Valley Demonstration Project

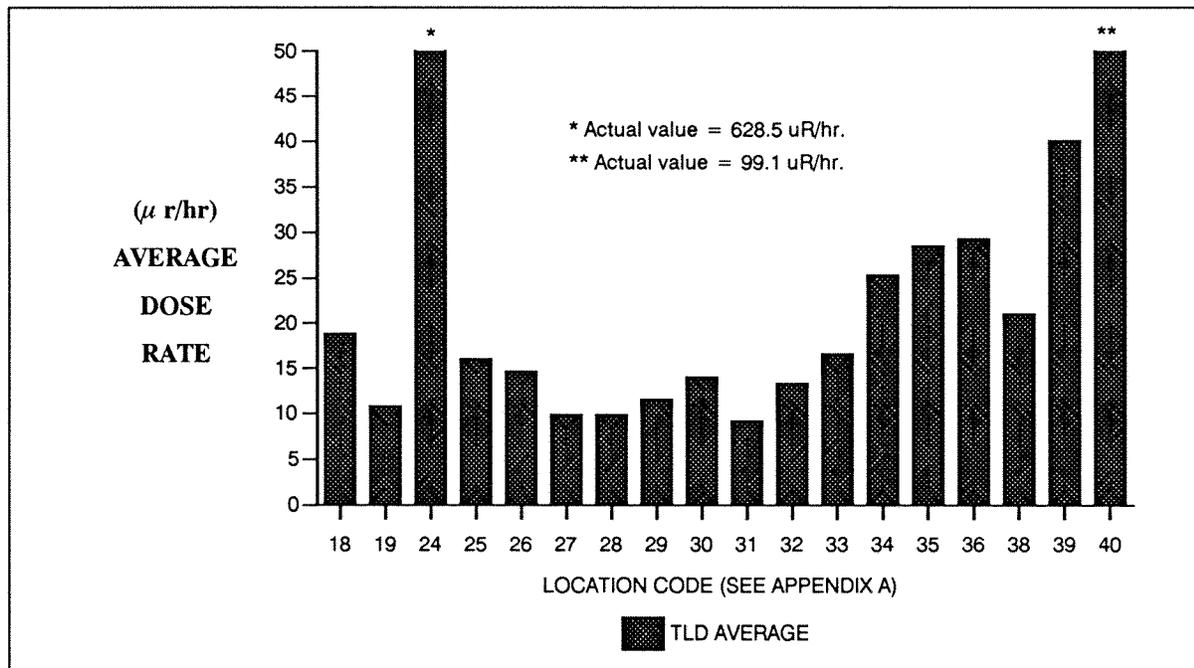
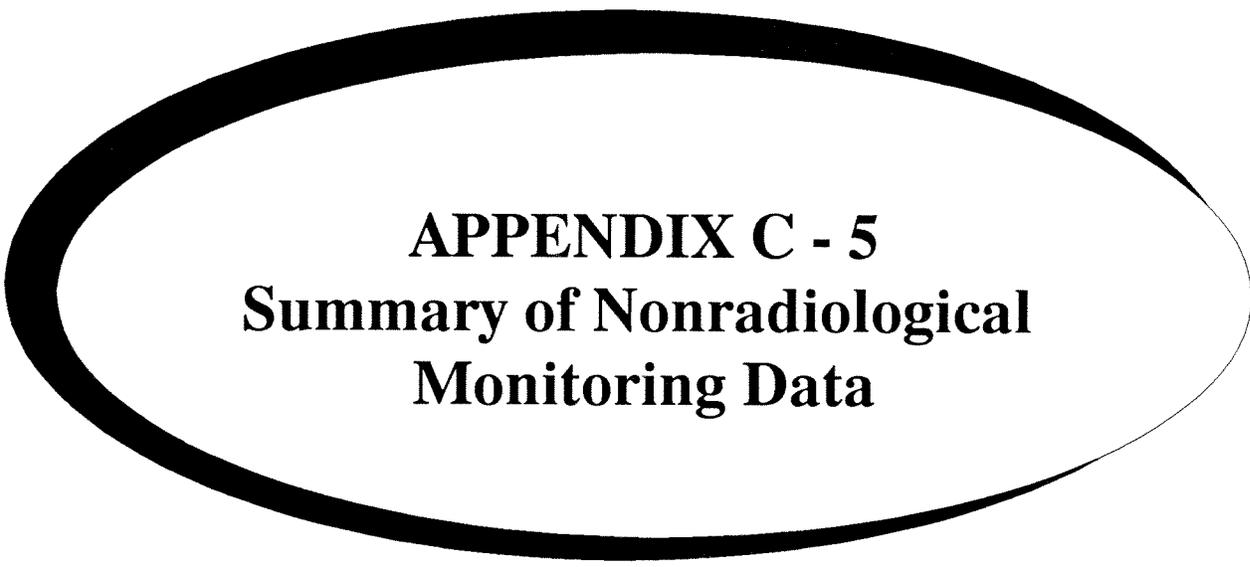


Figure C - 4.2

1990 Average Quarterly Gamma Exposure Rates On-site



Grab-Sampling Surface Water



APPENDIX C - 5
Summary of Nonradiological
Monitoring Data

TABLE C - 5.1

West Valley Demonstration Project State Pollutant Discharge Elimination System (SPDES)

Sampling Program Effective September 1990

Outfall	Parameter	Limit	Sample Frequency
001 (Process and Storm Wastewater)	Flow	Monitor	2 per discharge
	Aluminum, total	14.0 mg/L	2 per discharge
	Ammonia (NH ₃)	*	2 per discharge
	Arsenic, dissolved	0.15 mg/L	2 per discharge
	BOD-5	**	2 per discharge
	Iron, total	**	2 per discharge
	Zinc, total recoverable	0.48 mg/L	2 per discharge
	Solids, suspended	45.0 mg/L	2 per discharge
	Cyanide, amenable to chlor.	0.022 mg/L	2 per discharge
	Solids, settleable	0.3 mL/L	2 per discharge
	pH (range)	6.0-9.0	2 per discharge
	Oil & Grease	15.0 mg/L	2 per discharge
	Sulfate	Monitor	2 per discharge
	Nitrate	Monitor	2 per discharge
	Nitrite	Monitor	2 per discharge
	Chromium (hexavalent), total rec.	Monitor	2 per discharge
	Cadmium, total recoverable	0.007 mg/L	2 per discharge
	Copper, total recoverable	0.03 mg/L	2 per discharge
	Lead, total recoverable	0.15 mg/L	2 per discharge
	Nickel, total	2.7 mg/L	2 per discharge
	Dichlorodifluoromethane	0.01 mg/L	2 per discharge
	Trichlorofluoromethane	0.01 mg/L	2 per discharge
	3,3-Dichlorobenzidine	0.01 mg/L	2 per discharge
	Tributyl phosphate	32 mg/L	2 per discharge
	Vanadium	0.19 mg/L	2 per discharge
	Chromium, total	0.050 mg/L	annual
	Selenium, total	0.040 mg/L	annual
	Barium	0.5 mg/L	annual
	Antimony	1.0 mg/L	annual
	Chloroform	0.3 mg/L	annual
	Bis(2-Ethylhexyl)Phthalate	1.6 mg/L	semi-annual
	4-Dodecene	0.6 mg/L	semi-annual
	007 (Sanitary and Utility Wastewater)	Flow	Monitor
Ammonia (NH ₃)		*	3 per month
BOD-5		**	3 per month
Iron, total		**	3 per month
Suspended solids		45.0 mg/L	2 per month
Settleable solids		0.3 mL/L	weekly
pH (range)		6.0-9.0	weekly
Chloroform		0.020 mg/L	annual
008 (French Drain Wastewater)	Flow	Monitor	3 per month
	BOD-5	**	3 per month
	Iron, total	**	3 per month
	pH (range)	6.0-9.0	weekly
	Silver, total	0.008 mg/L	annual
	Zinc, total	0.100 mg/L	annual

* Reported as flow-weighted average of outfalls 001 and 007. Limit is 2.1 mg/L.

** Reported as flow-weighted average of outfalls 001, 007, and 008. Limits are 5.0 mg/L for BOD-5 and 0.31 mg/L for Fe. Iron data are net limits reported after background concentrations are subtracted.

TABLE C - 5.2

West Valley Demonstration Project 1990 SPDES Noncompliance Episodes

Date	Outfall	Parameter	Limit	Value	Comments
FEB 90	Sum 001,007 008	NH3	2.1 mg/L	3.46 mg/L	STP Flow-through
FEB 90	Sum 001,007 008	NH3	2.1 mg/L	3.86 mg/L	As above
FEB 90	Sum 001,007 008	NH3	2.1 mg/L	3.27 mg/L	As above
FEB 90	Sum 001,007 008	NH3	2.1 mg/L	2.81 mg/L	As above
FEB 90	Sum 001,007 008	NH3	2.1 mg/L	5.21 mg/L	As above
FEB 90	Sum 001,007 008	NH3	2.1 mg/L	3.97 mg/L	As above
FEB 90	Sum 001,007 008	BOD-5	5.0 mg/L	12.04 mg/L	Related to above
NOV 90	Sum 001,007, 008	Fe	0.31 mg/L	0.87 mg/L	001 Fe high
NOV 90	007	Settleable Solids	0.3 mL/L	0.5 mL/L	Floc material

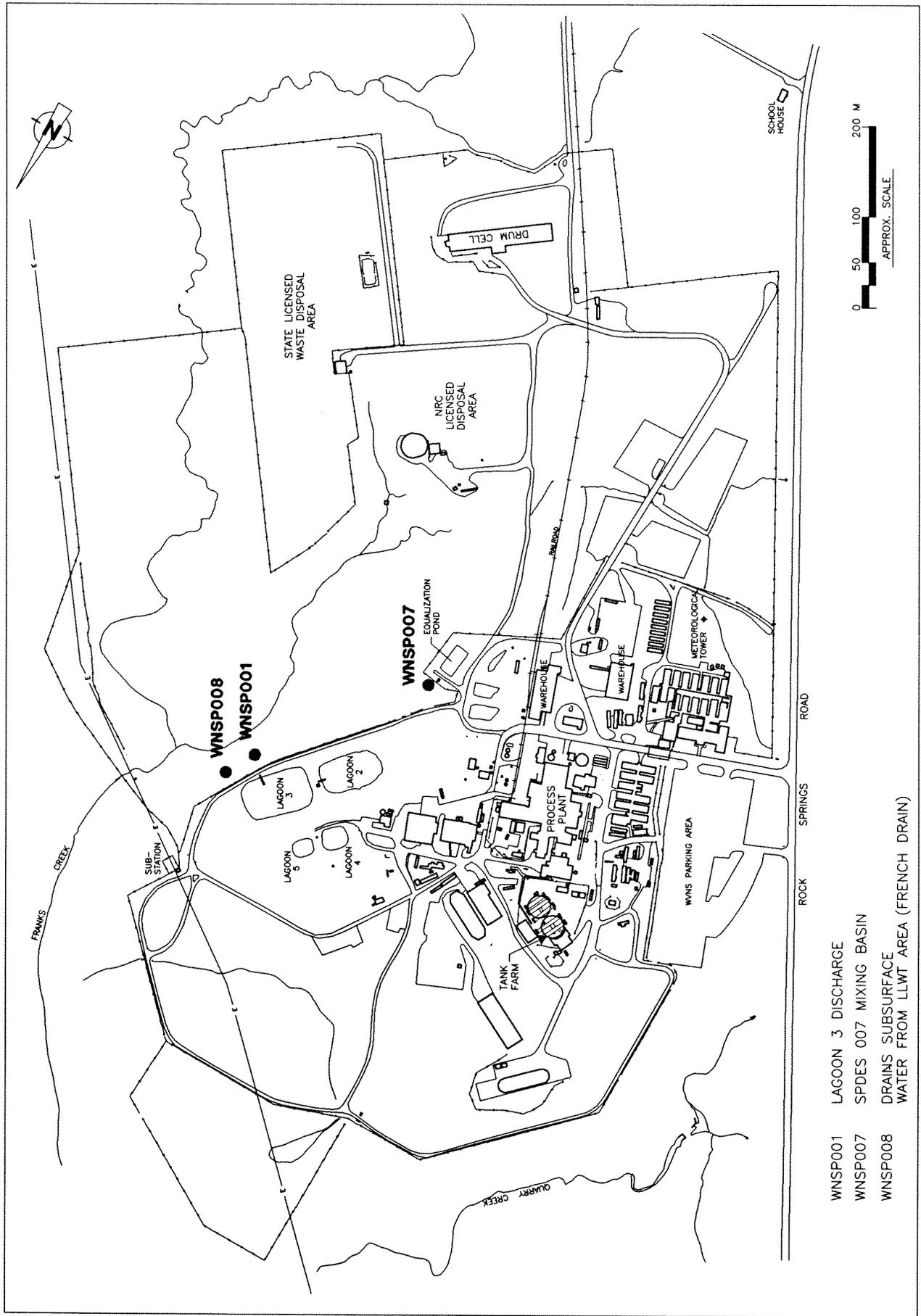


Figure C-5.1. Location of SPDES Monitoring Points.

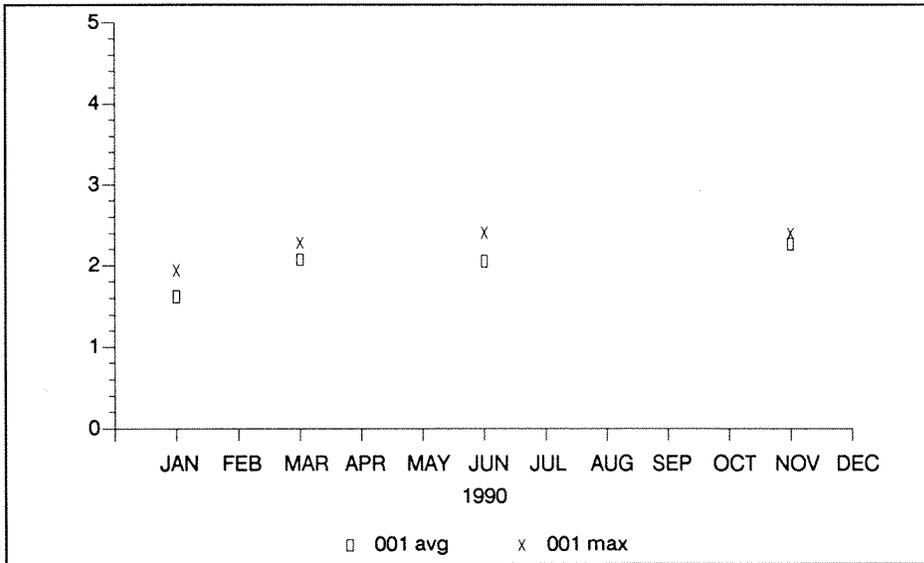


Figure C-5.2

Biochemical Oxygen Demand - 5

(mg/L)

Outfall 001

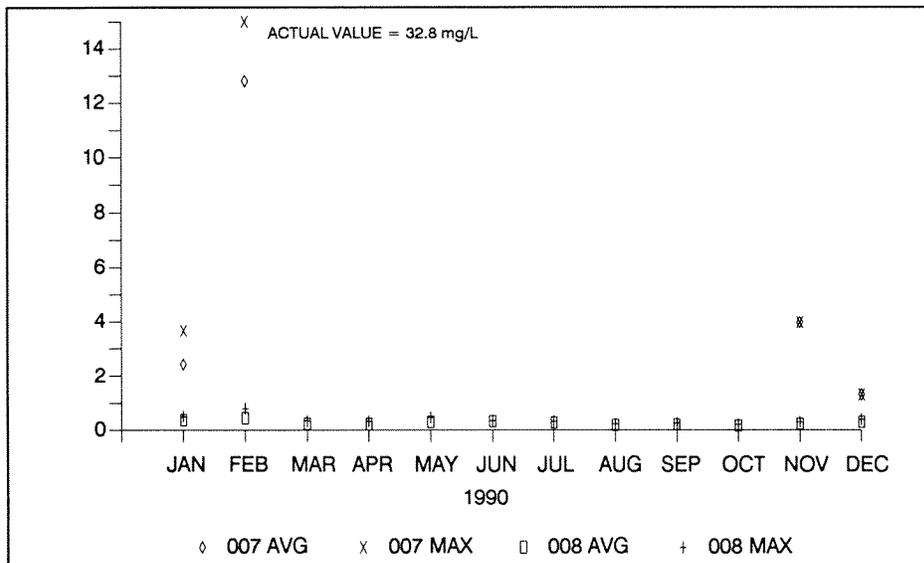


Figure C - 5.3

Biochemical Oxygen Demand - 5

(mg/L)

Outfalls 007 and 008

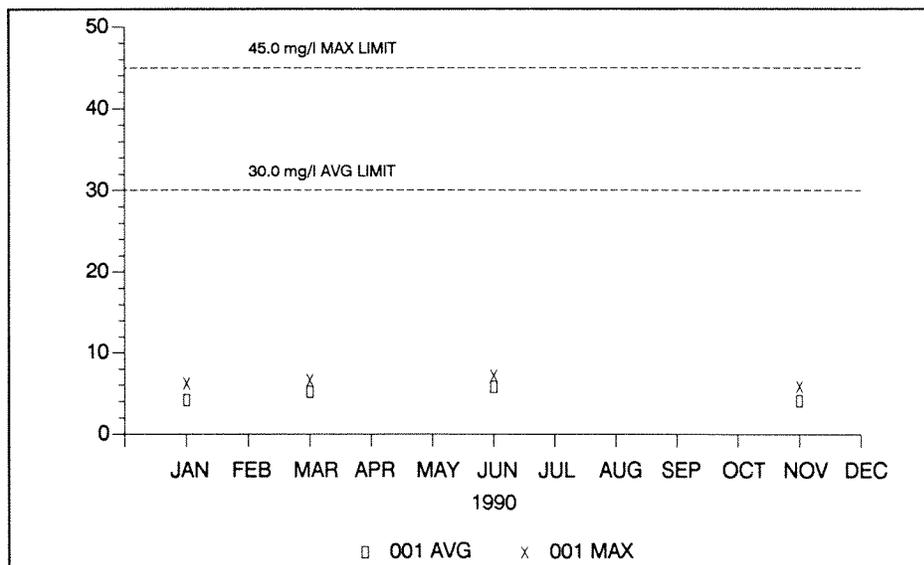


Figure C - 5.4

Suspended Solids

(mg/L)

Outfall 001

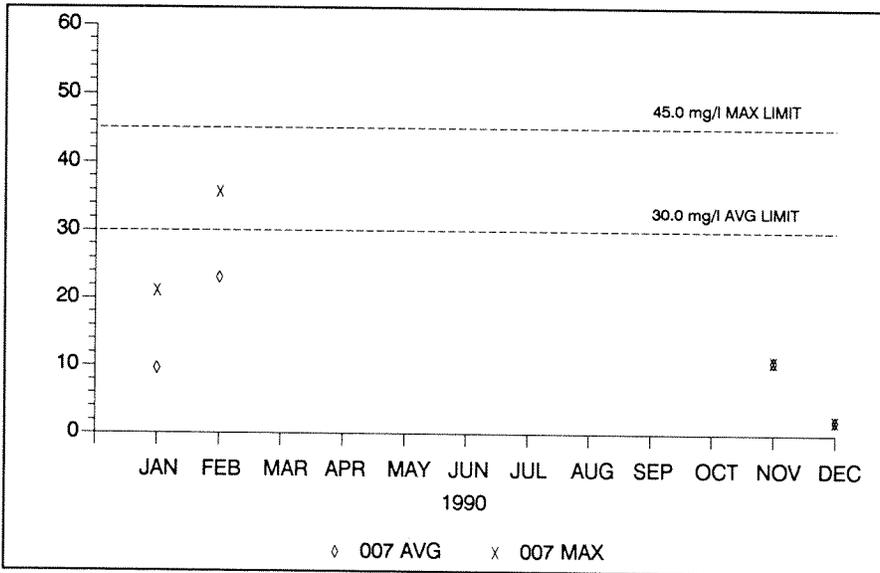


Figure C - 5. 5

Suspended Solids
(mg/L)

Outfall 007

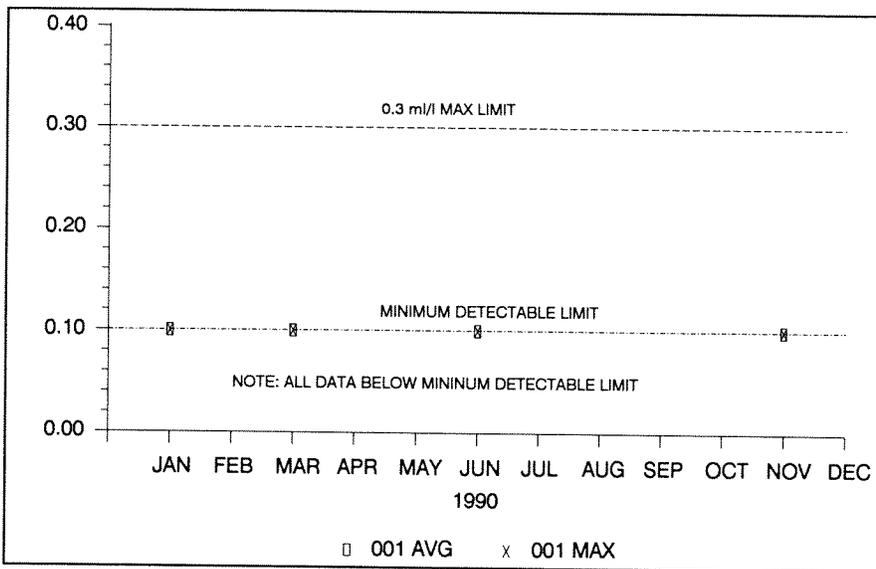


Figure C - 5. 6

Settleable Solids
(ml/L)

Outfall 001

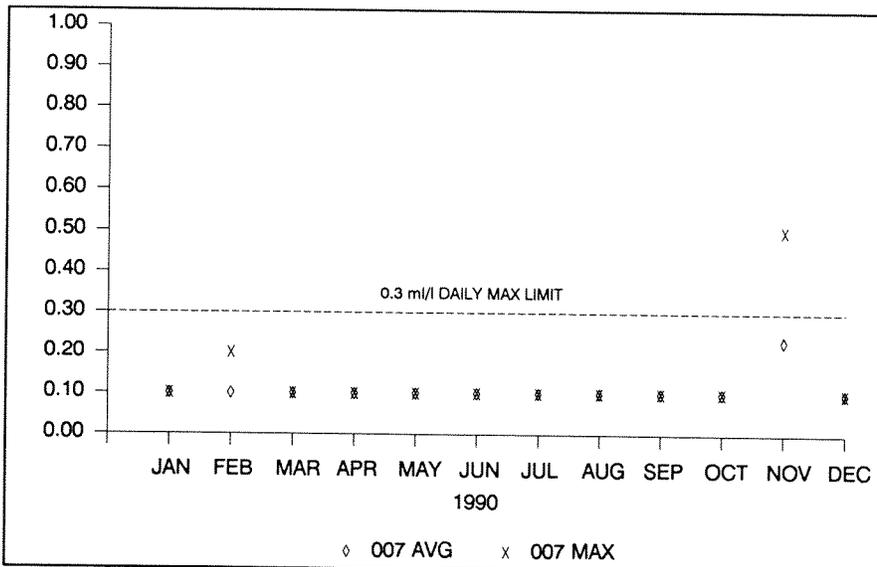


Figure C - 5.7

Settleable Solids
(ml/L)

Outfall 007

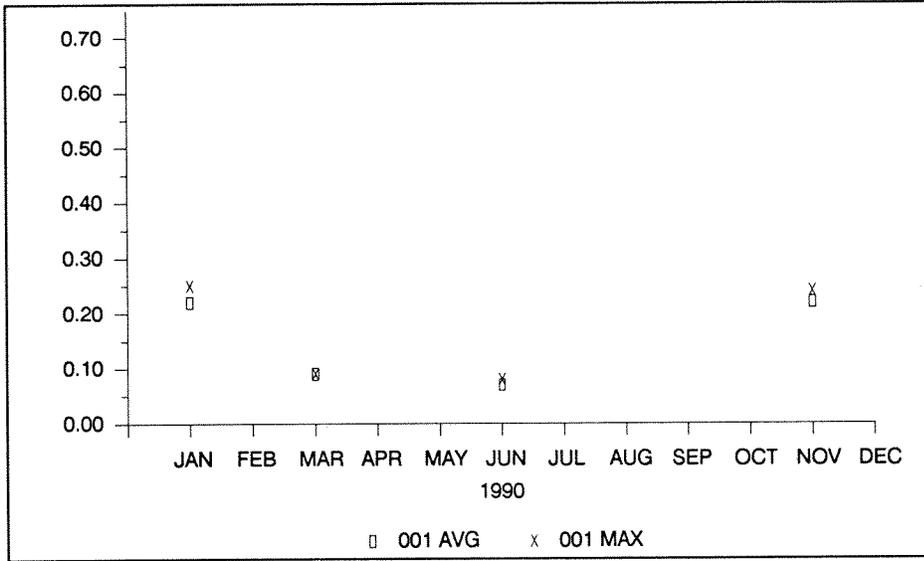


Figure C - 5. 8

**Ammonia
(mg/L)**

Outfall 001

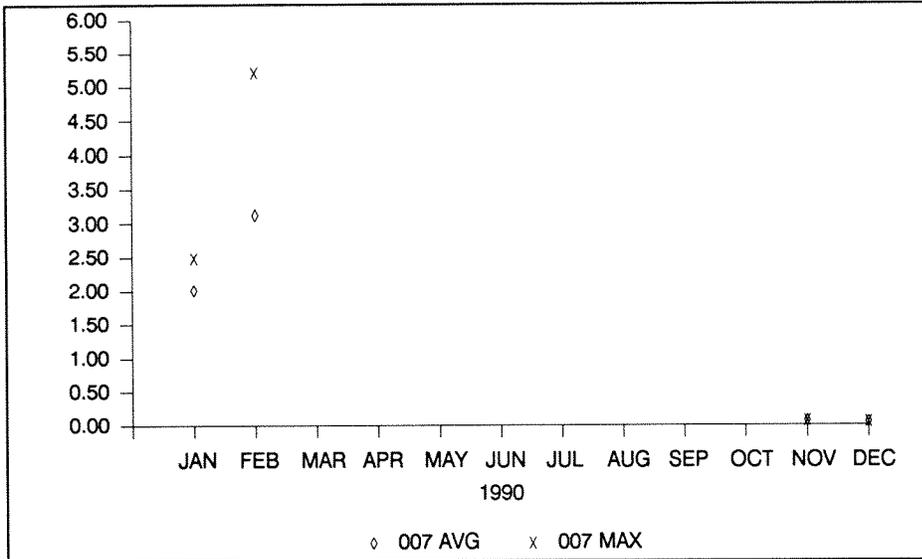


Figure C - 5. 9

**Ammonia
(mg/L)**

Outfall 007

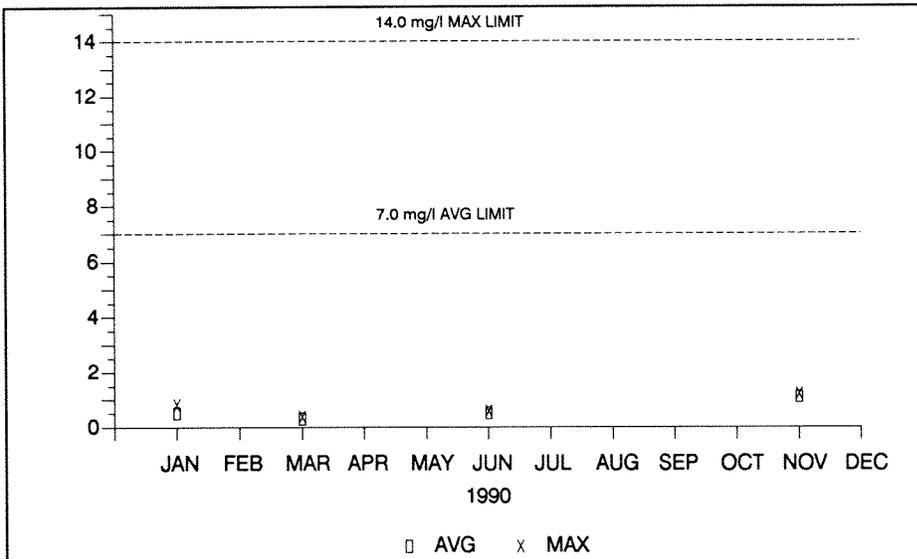


Figure C - 5. 10

**Metals - Aluminum
(Al)
(mg/L)**

Outfall 001

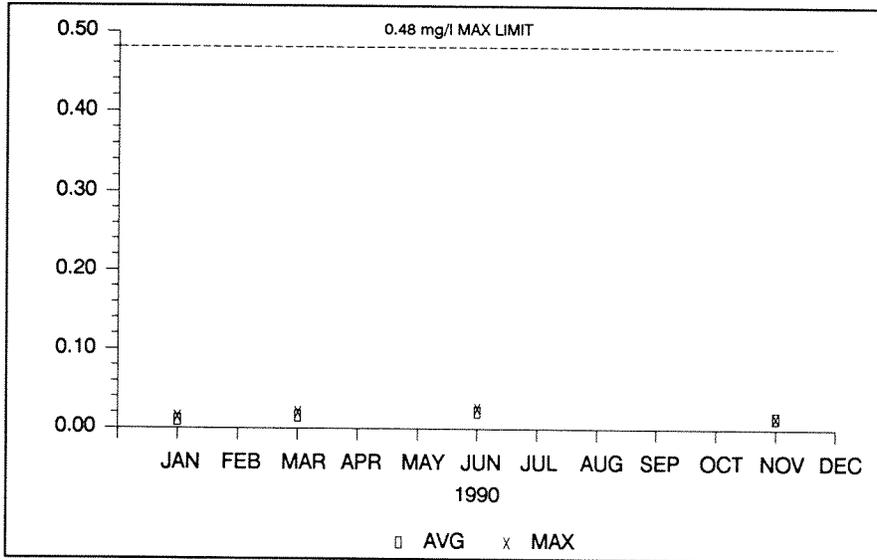


Figure C - 5.11

**Metals - Zinc (Zn)
Total Recoverable
(mg/L)**

Outfall 001

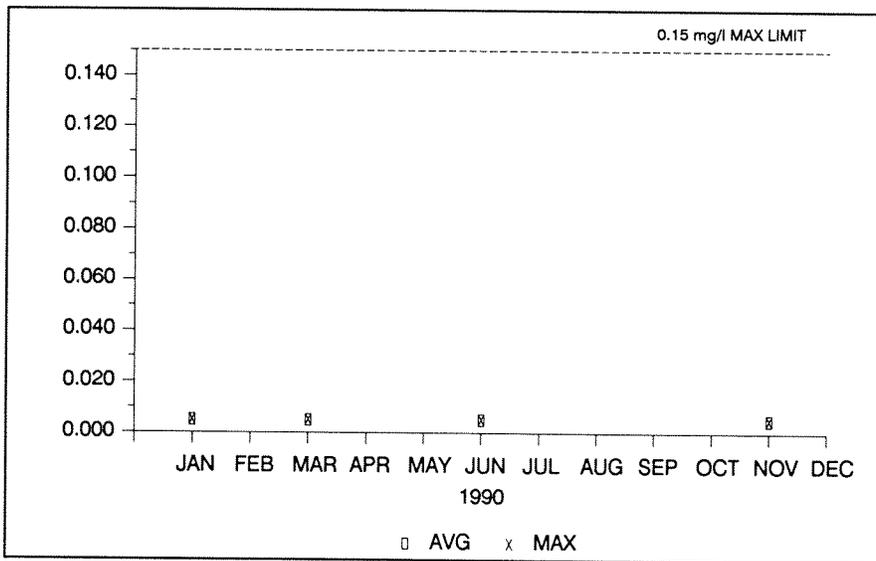


Figure C - 5.12

**Metals - Arsenic (As)
Dissolved
(mg/L)**

Outfall 001

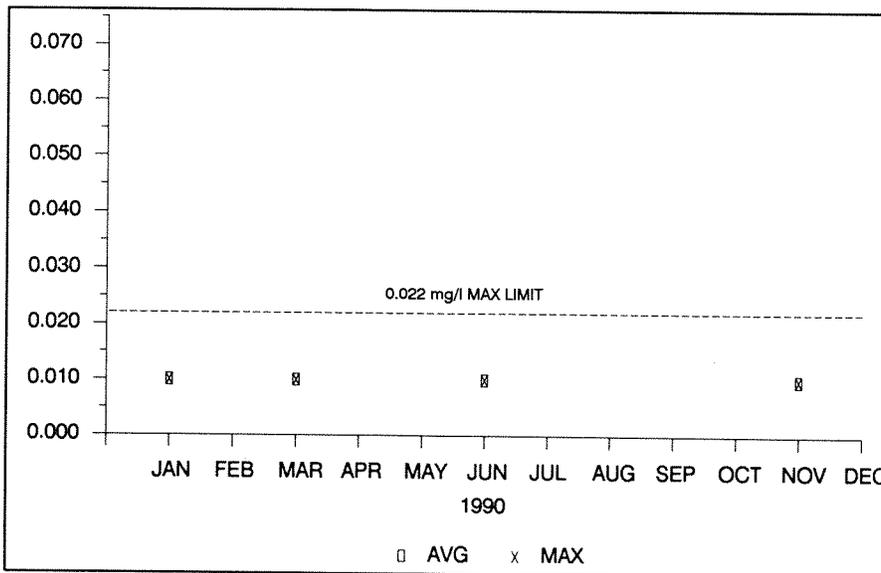


Figure C - 5.13

**Cyanide Amenable to
Chlorination
(mg/L)**

Outfall 001

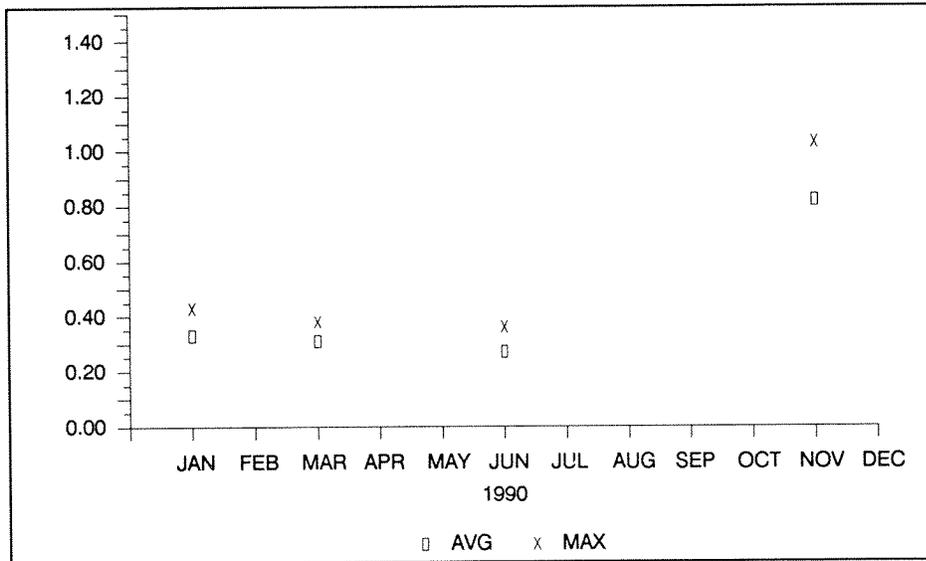


Figure C - 5.14

Metals - Iron (Fe)
(mg/L)

Outfall 001

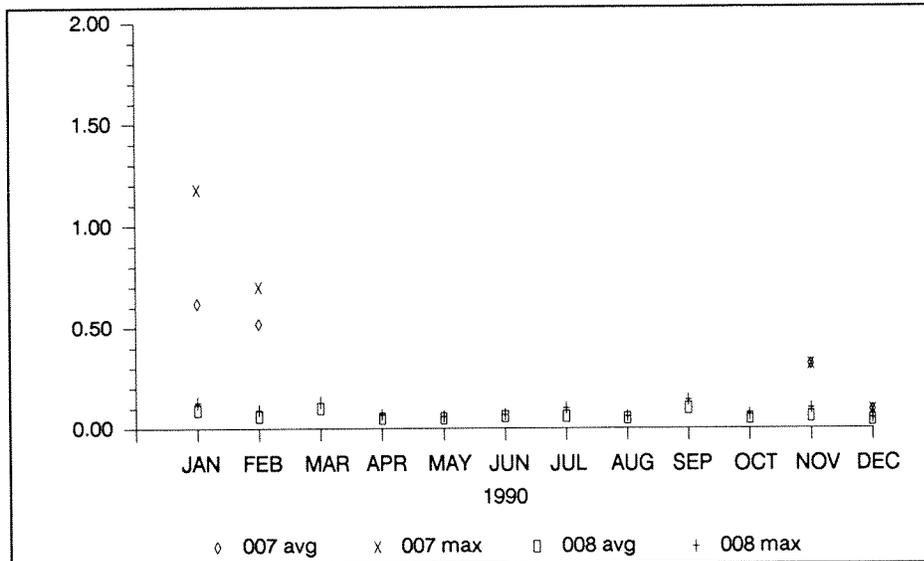


Figure C - 5.15

Metals - Iron (Fe)
(mg/L)

Outfalls 007 and 008

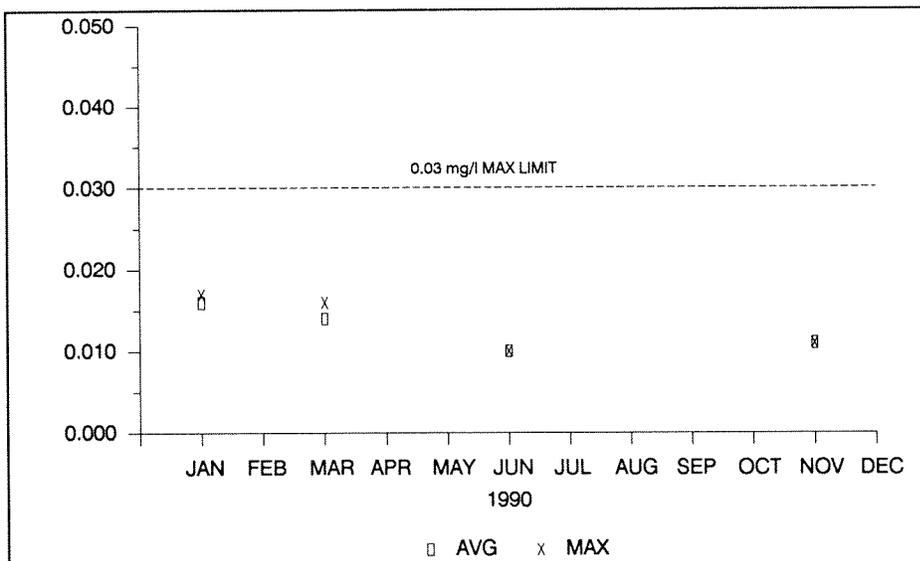


Figure C - 5.16

Metals - Copper (Cu)
Total Recoverable
(mg/L)

Outfall 001

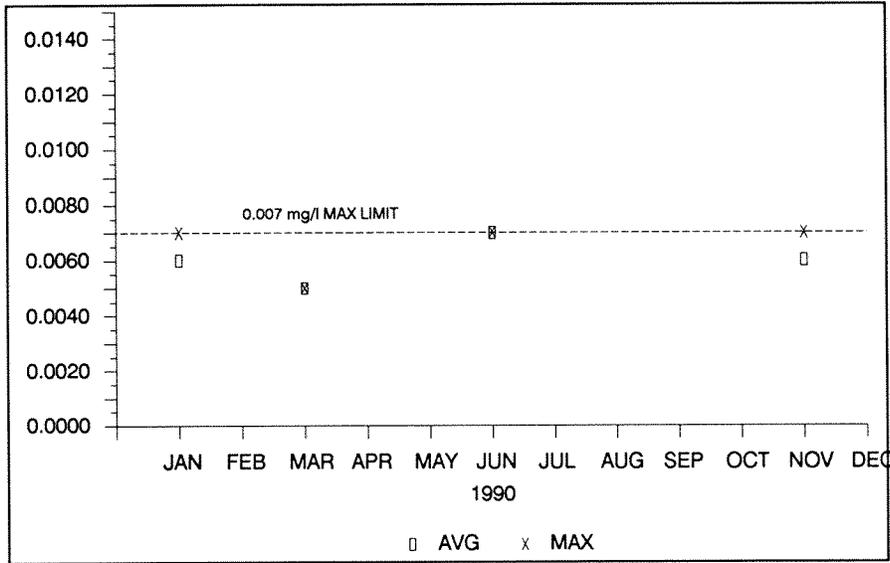


Figure C - 5.17

Metals - Cadmium (Cd)
Total Recoverable
(mg/L)

Outfall 001

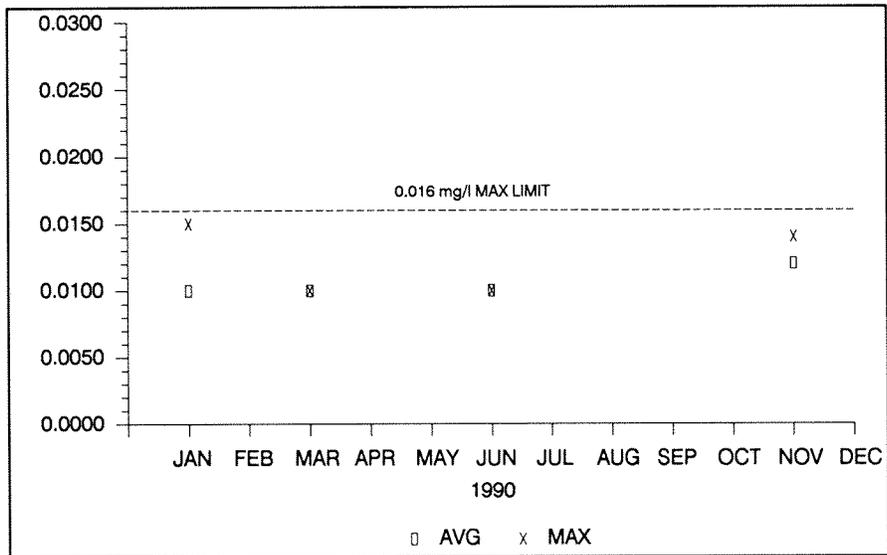


Figure C - 5.18

Metals - Chromium (Cr, VI)
Total Recoverable
(mg/L)

Outfall 001

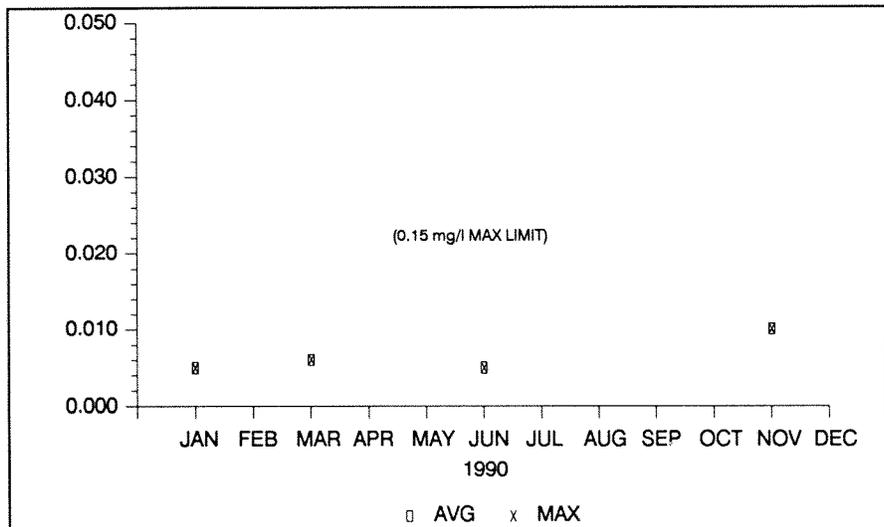


Figure C - 5.19

Metals - Lead (Pb)
(mg/L)

Outfall 001

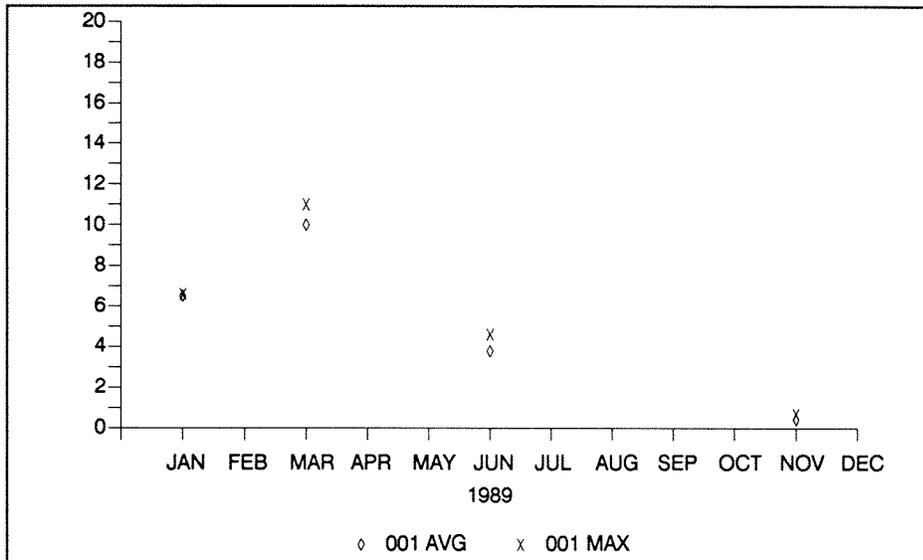


Figure C - 5.20

Nitrate (NO-3)
(mg/L)

Outfall 001

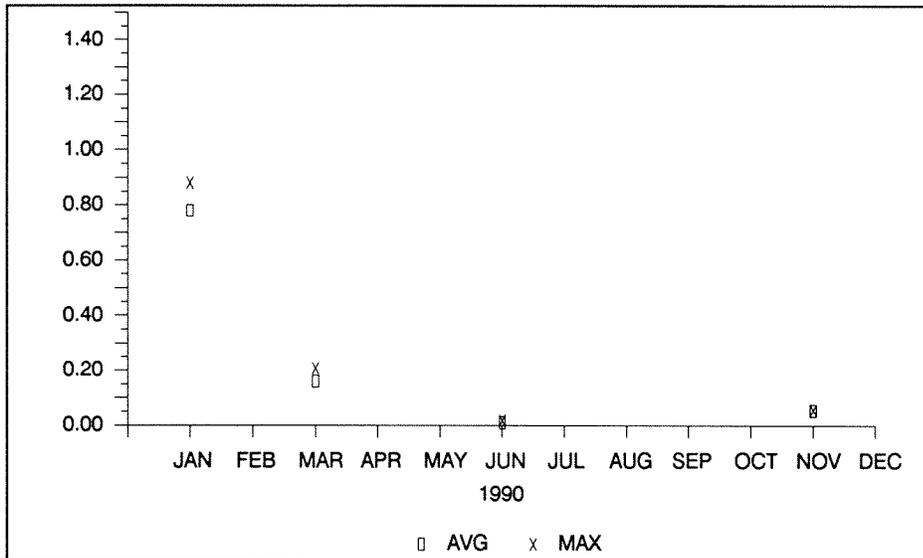


Figure C - 5.21

Nitrite (NO-2)
(mg/L)

Outfall 001

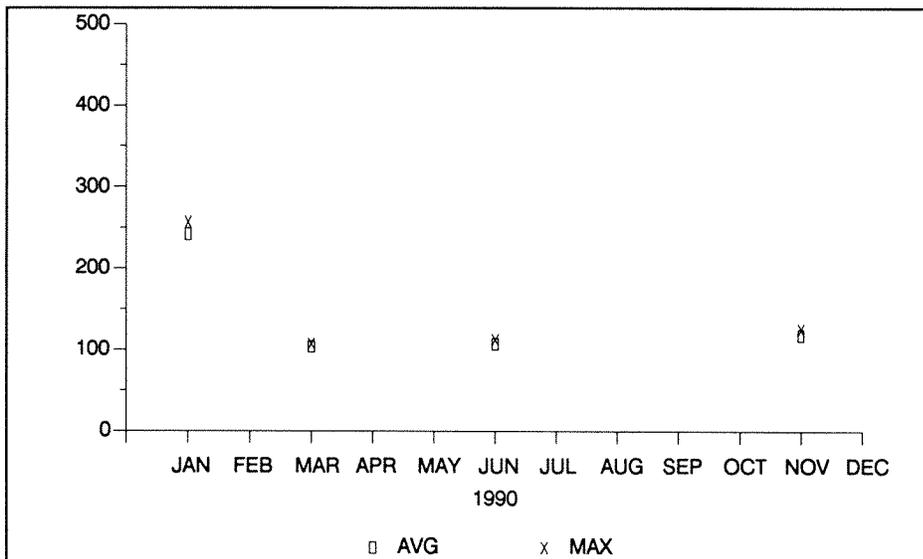
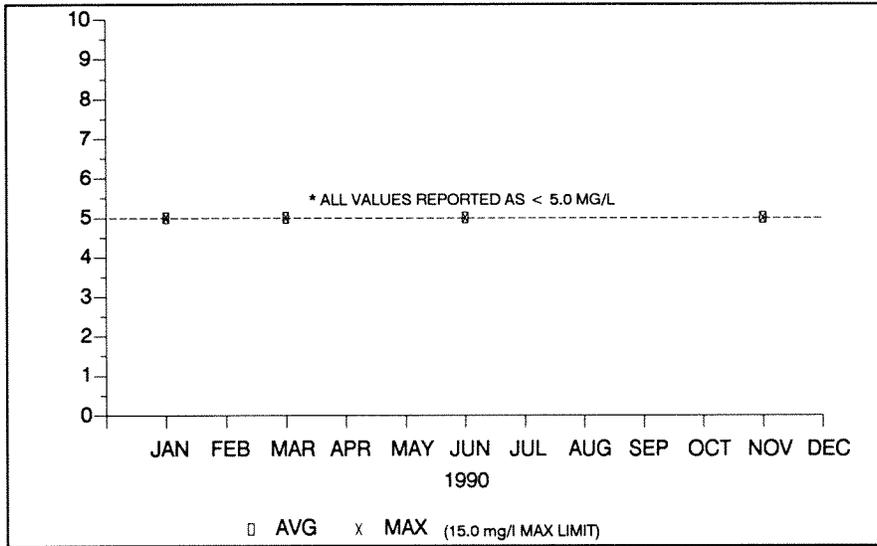


Figure C - 5.22

Sulfate
(mg/L)

Outfall 001

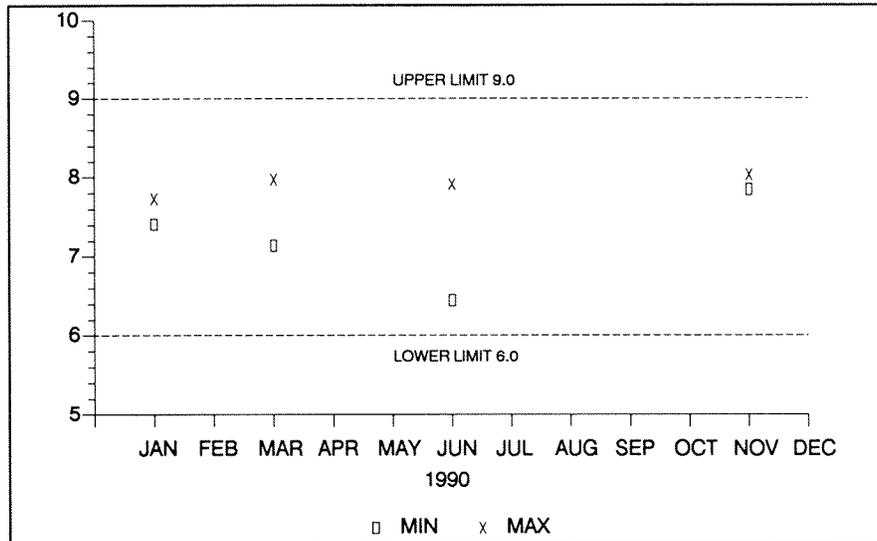
Figure C - 5. 23



Oil and Grease
(mg/L)

Outfall 001

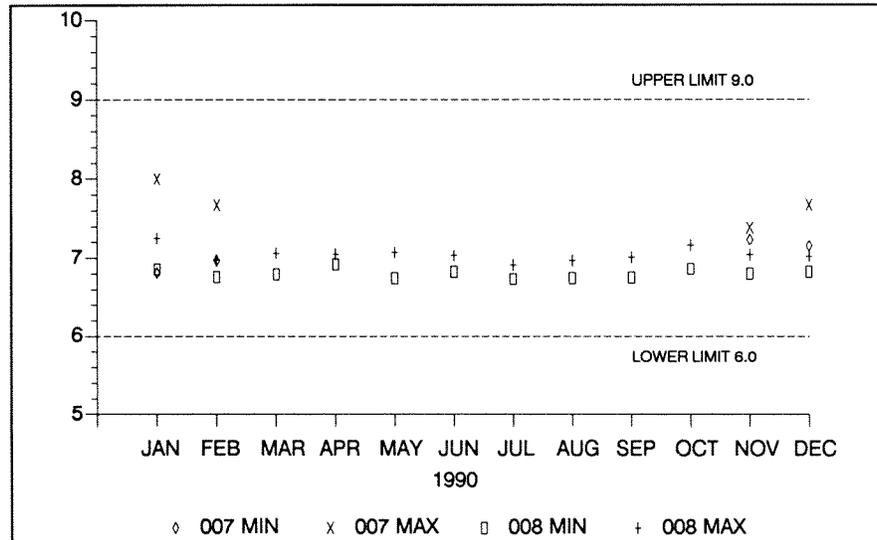
Figure C - 5. 24



pH (standard units)

Outfall 001

Figure C - 5. 25



pH (standard units)

Outfalls 007 and 008

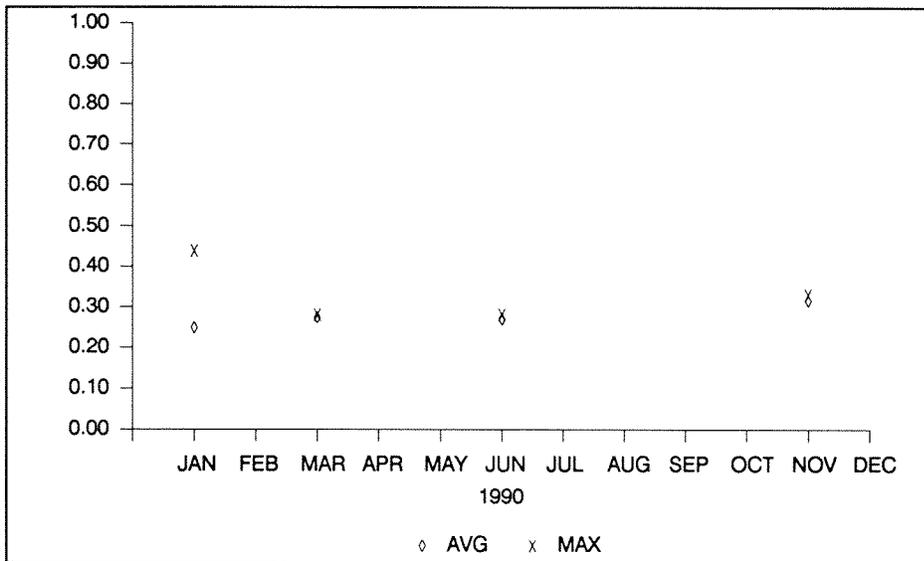


Figure C - 5.26

**Discharge Rate
(MGD)**

Outfall 001

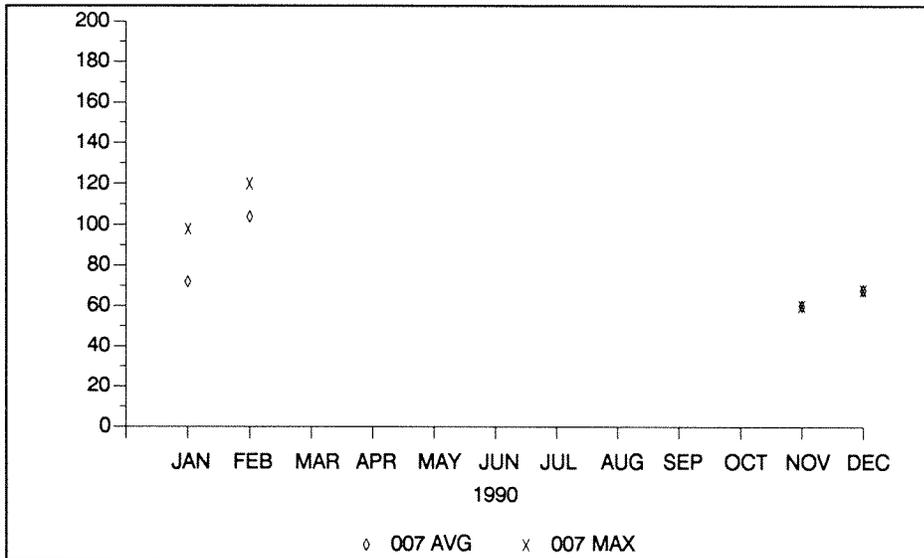


Figure C - 5.27

**Discharge Rate
(GPD x 1000)**

Outfall 007

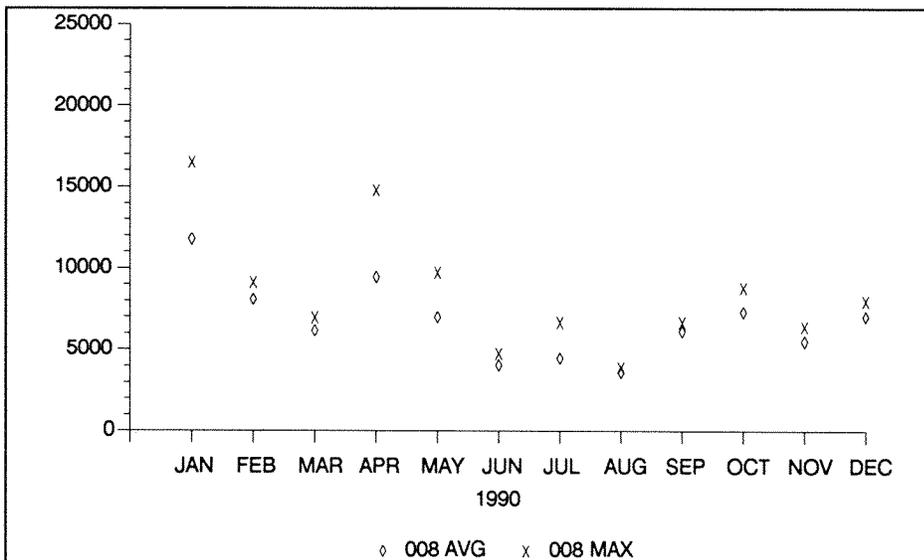


Figure C - 5.28

**Discharge Rate
(GPD)**

Outfall 008

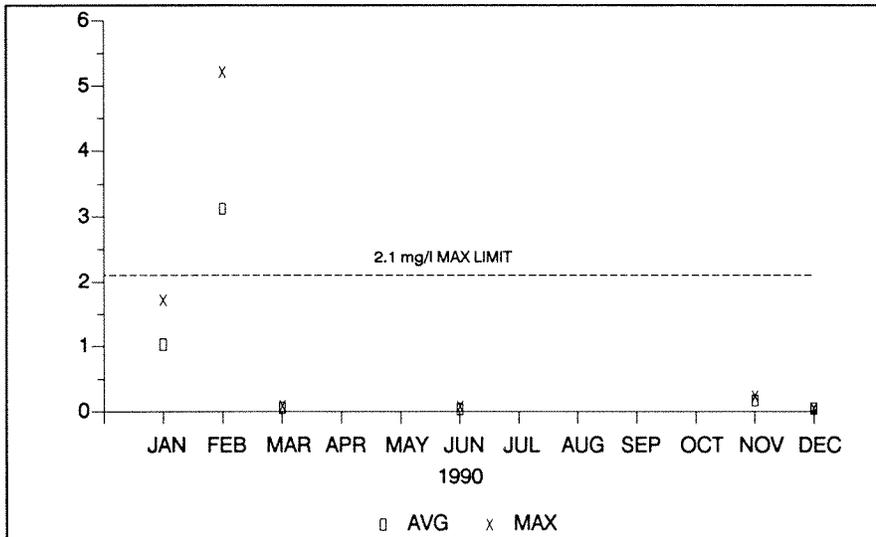


Figure C - 5. 29

Flow-weighted Averages

Ammonia
(mg/L)

Outfalls 001 and 007

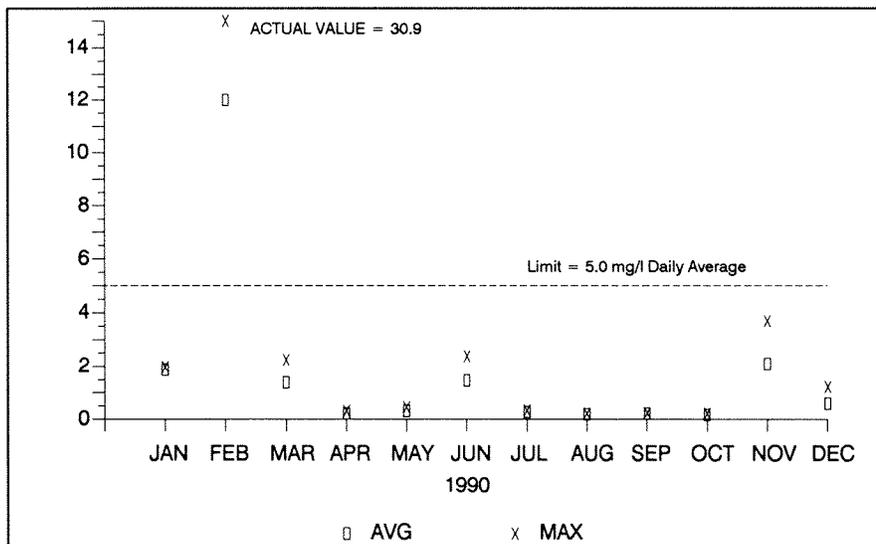


Figure C - 5. 30

Flow-weighted Averages

Biochemical Oxygen
Demand - 5
(mg/L)

Outfalls 001, 007, and
008

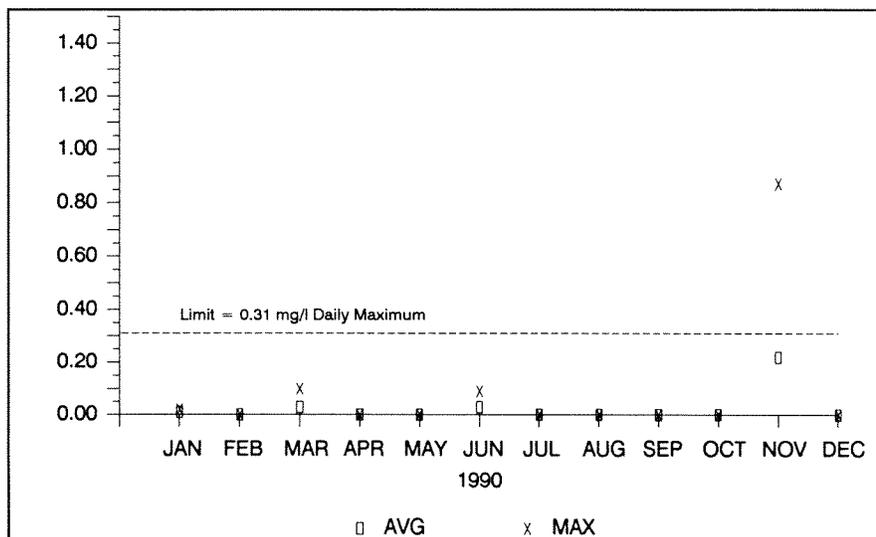


Figure C - 5. 31

Flow-weighted Averages

Iron (Fe)
(mg/L)

Outfalls 001, 007, and
008

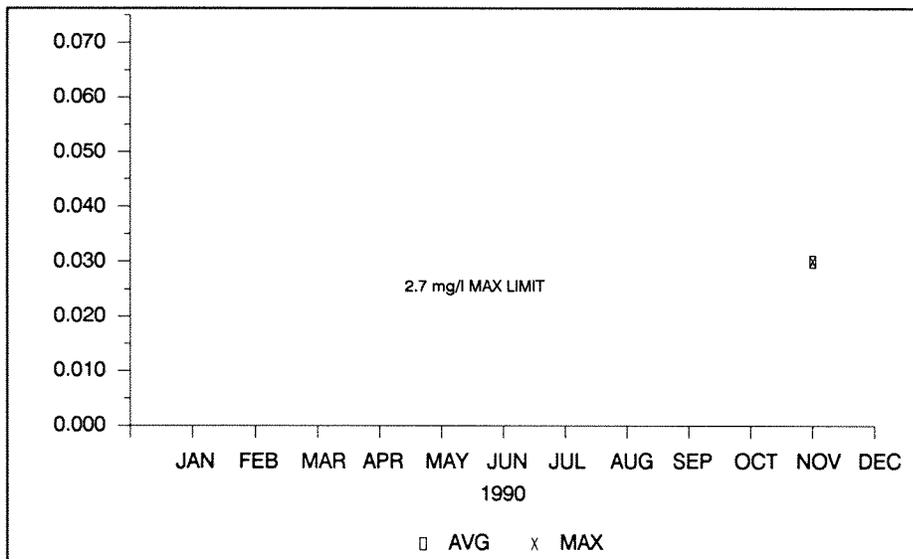


Figure C - 5.32

**Nickel
(mg/L)
Outfall 001**

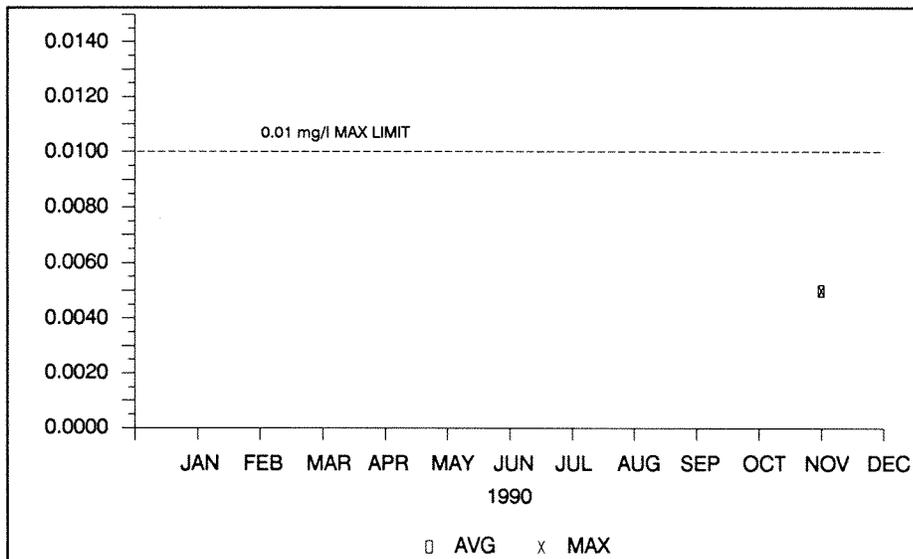


Figure C - 5.33

**Trichlorofluoromethane
(mg/L)
Outfall 001**

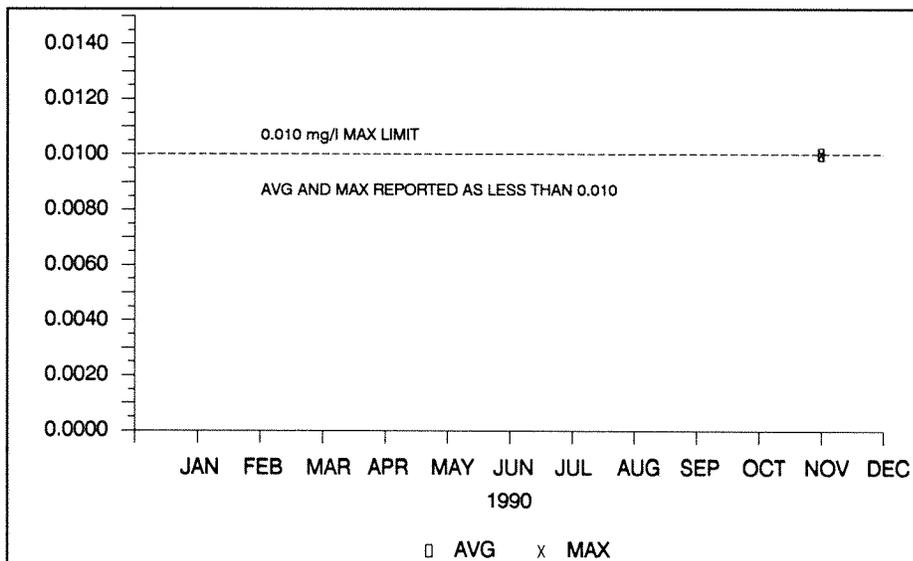


Figure C - 5.34

**3,3 - dichlorobenzidine
(mg/L)
Outfall 001**

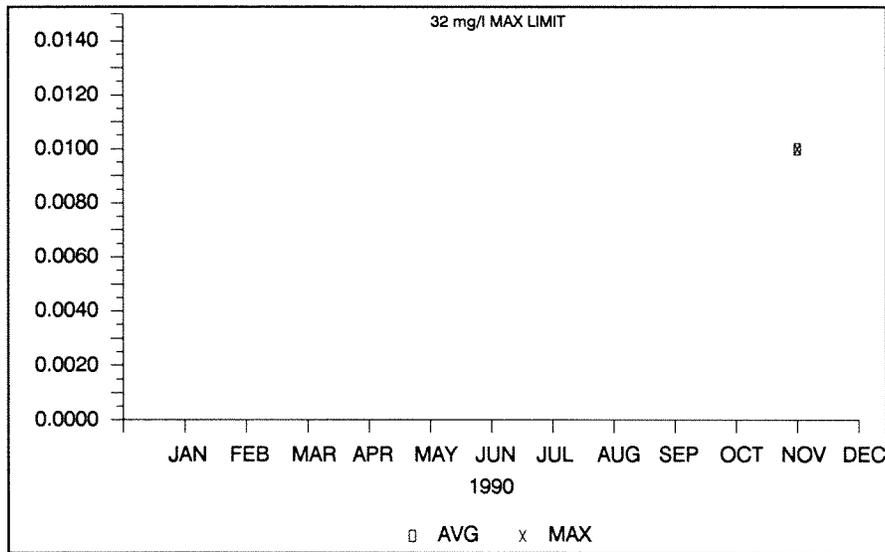


Figure C - 5.35

**Tributyl phosphate
(mg/L)
Outfall 001**

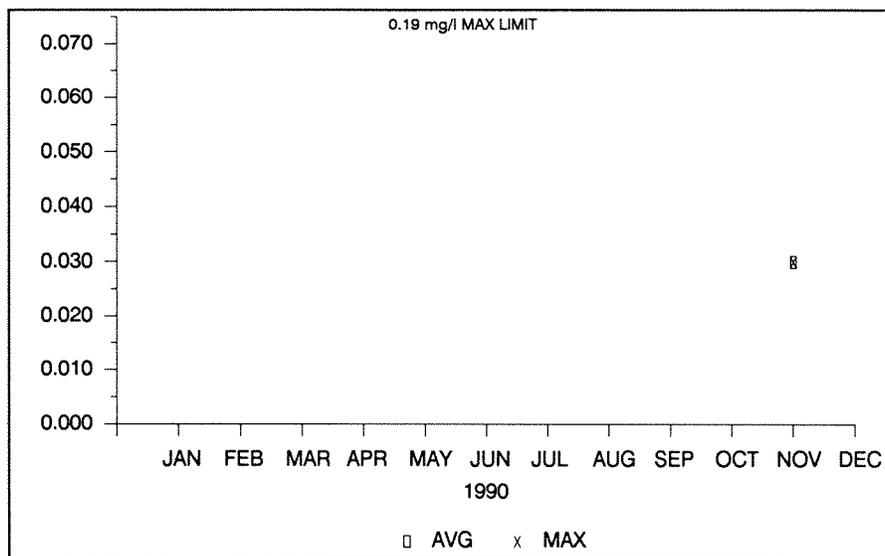
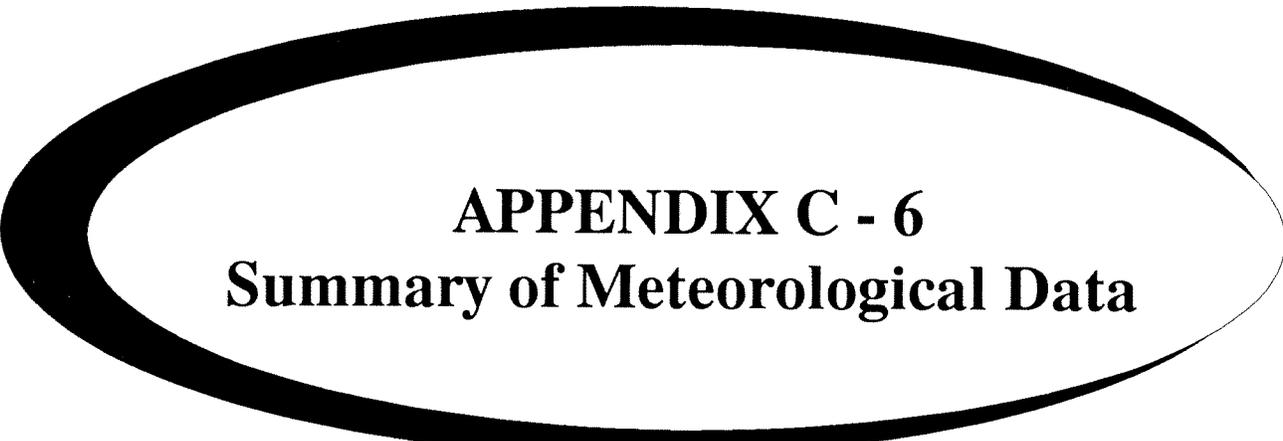


Figure C - 5.36

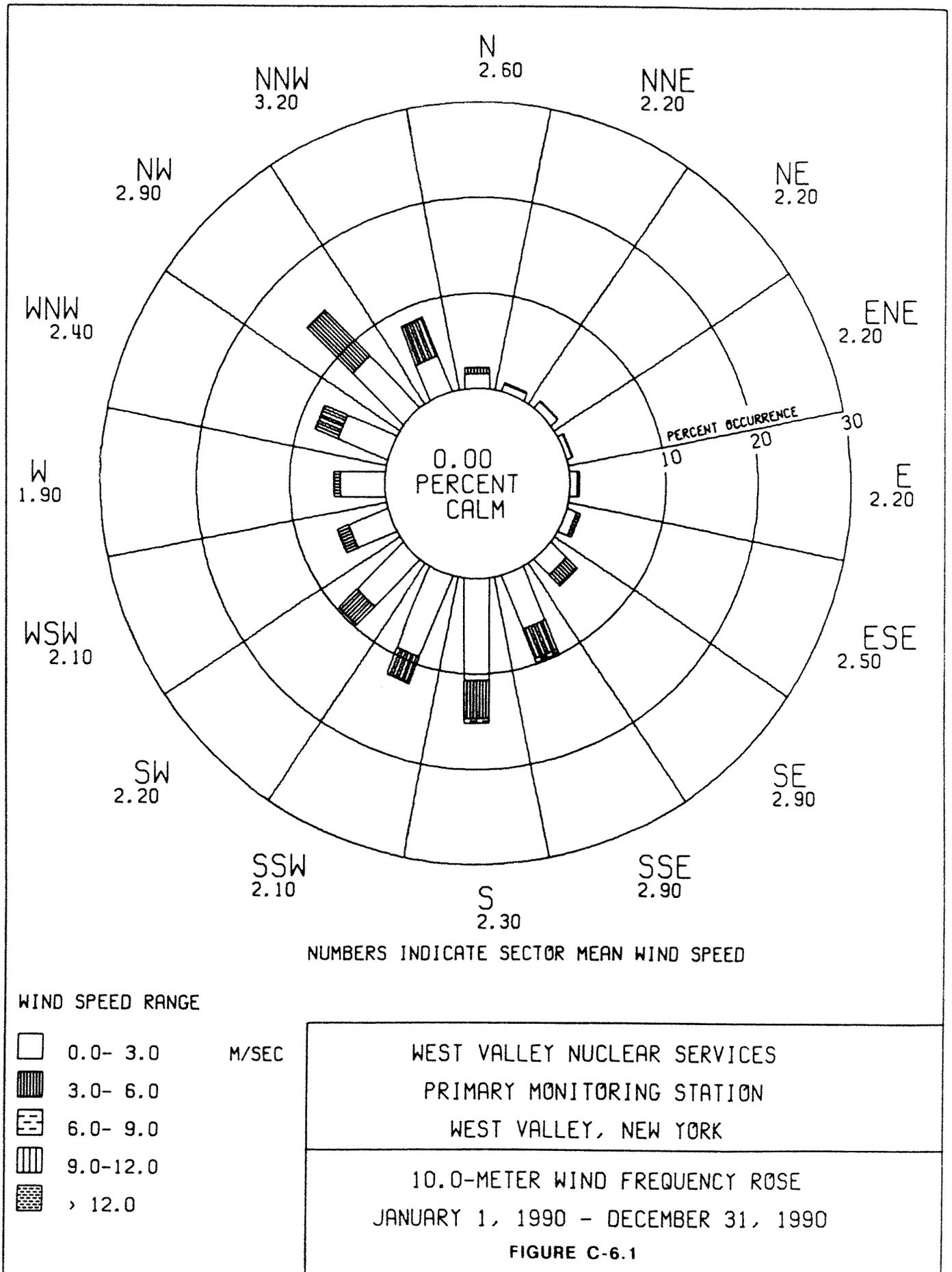
**Vanadium
(mg/L)
Outfall 001**

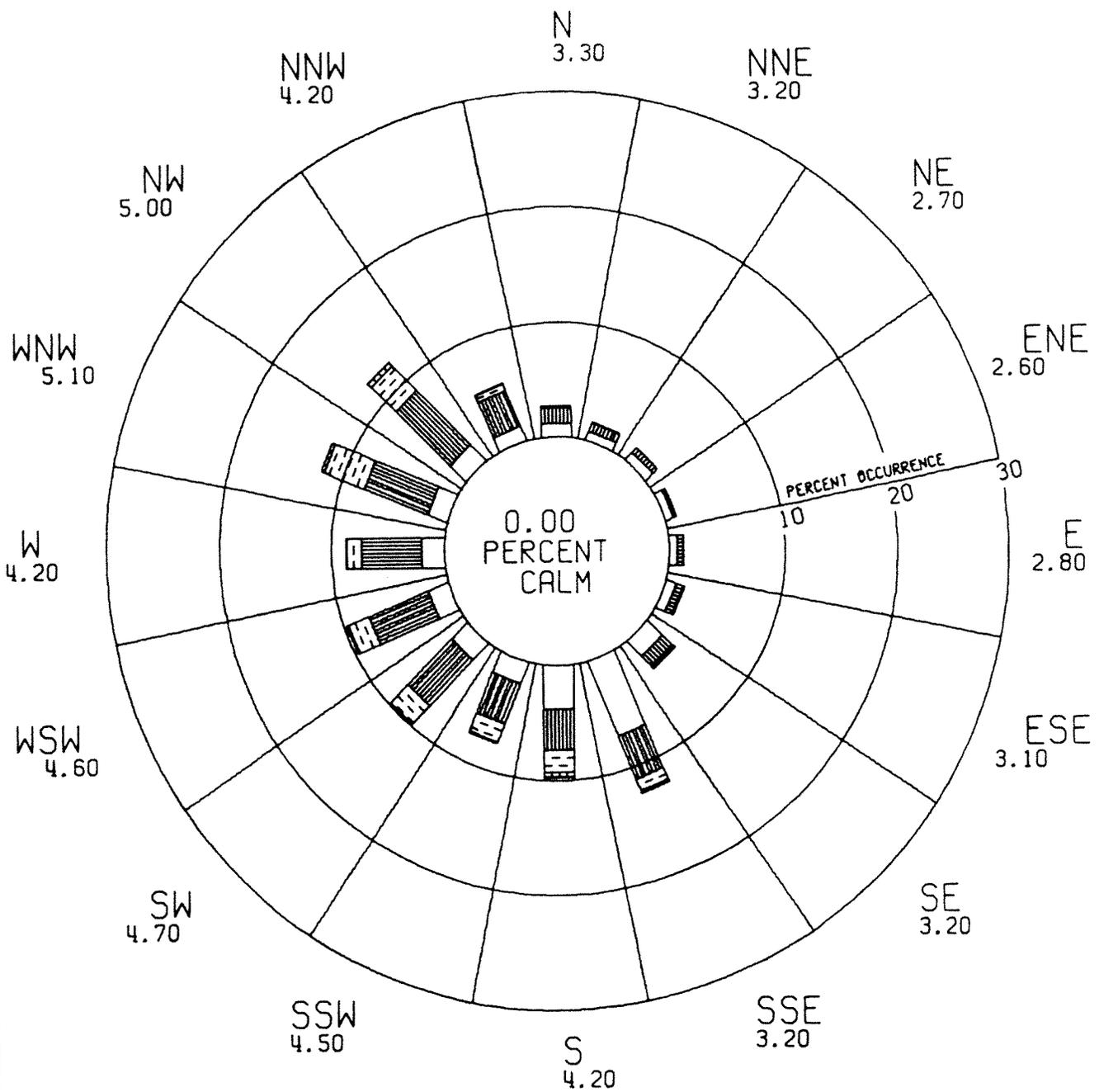


On-site Meteorological Tower and Rain Gage



APPENDIX C - 6
Summary of Meteorological Data





NUMBERS INDICATE SECTOR MEAN WIND SPEED

WIND SPEED RANGE

- 0.0- 3.0 M/SEC
- ▨ 3.0- 6.0
- ▤ 6.0- 9.0
- ▥ 9.0-12.0
- ▧ > 12.0

WEST VALLEY NUCLEAR SERVICES
 PRIMARY MONITORING STATION
 WEST VALLEY, NEW YORK

60.0-METER WIND FREQUENCY ROSE
 JANUARY 1, 1990 - DECEMBER 31, 1990

FIGURE C-6.2

TABLE C - 6.1

West Valley Demonstration Project 1990 Site Rainfall Collection Data (inches) for week ending:

JAN 02	0.20	APR 03	0.71	JUL 03	0.02	OCT 02	0.91
JAN 09	0.19	APR 10	1.58	JUL 10	1.86	OCT 09	2.85
JAN 16	0.62	APR 17	1.71	JUL 17	0.96	OCT 16	2.44
JAN 23	0.84	APR 24	0.59	JUL 24	1.07	OCT 23	1.68
JAN 30	0.81	MAY 01	0.08	JUL 31	0.00	OCT 30	0.67
FEB 06	1.28	MAY 08	1.57	AUG 07	0.52	NOV 06	0.84
FEB 13	0.60	MAY 15	2.19	AUG 14	1.16	NOV 13	0.84
FEB 20	2.16	MAY 22	2.22	AUG 21	0.34	NOV 21	0.37
FEB 27	0.78	MAY 29	0.34	AUG 28	1.89	NOV 28	0.86
MAR 06	0.00	JUN 05	0.64	SEP 04	0.08	DEC 04	1.12
MAR 13	0.61	JUN 12	0.44	SEP 11	3.07	DEC 11	0.12
MAR 20	1.03	JUN 19	0.66	SEP 18	1.18	DEC 18	1.68
MAR 27	0.15	JUN 26	0.34	SEP 25	1.31	DEC 25	1.40
						DEC 31	1.92

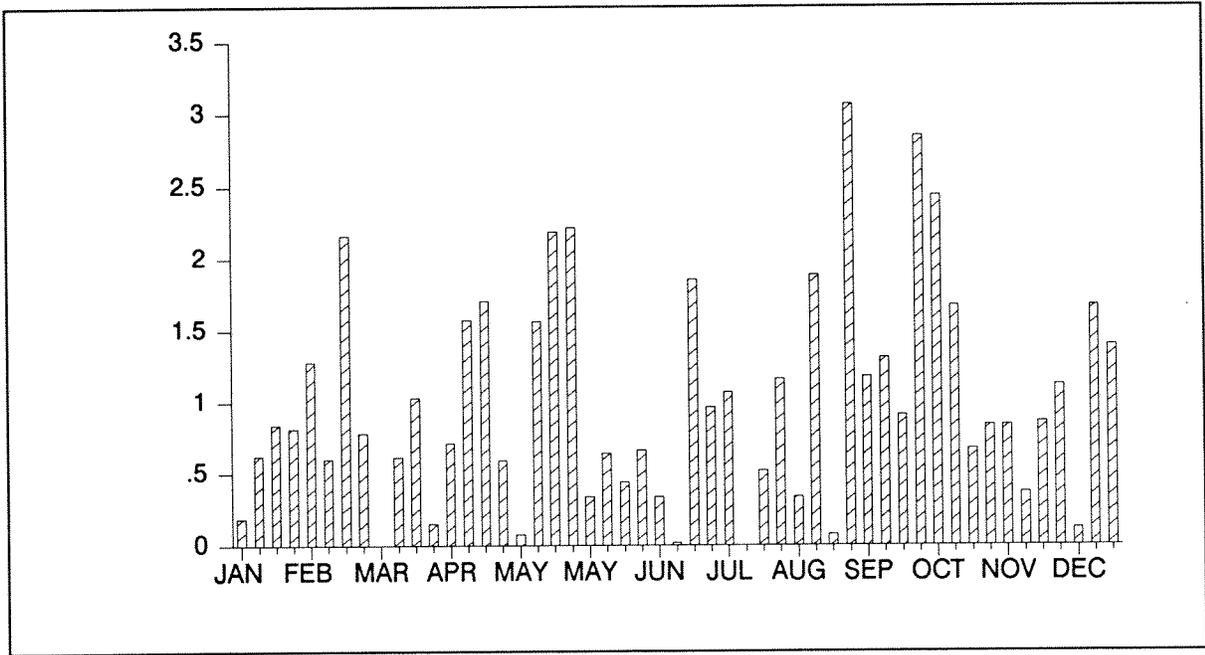


Figure C - 6.3
1990 Weekly Rainfall Total (inches)

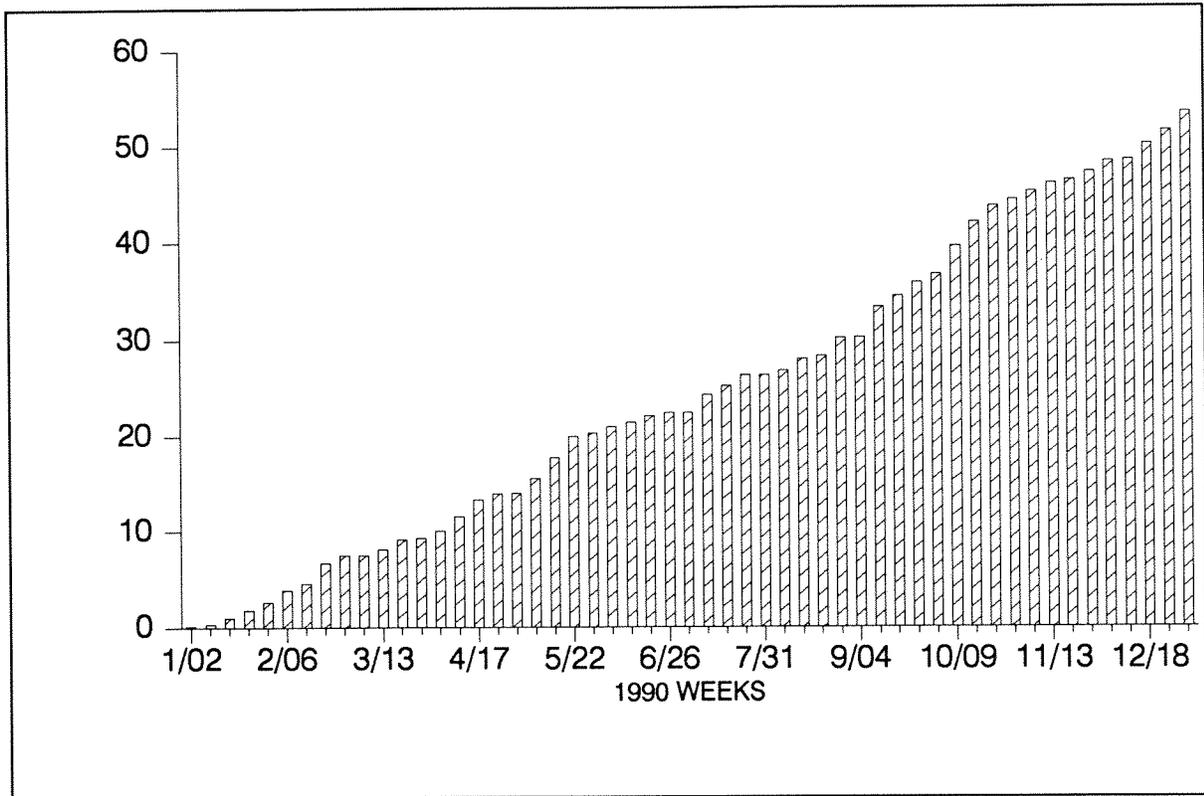
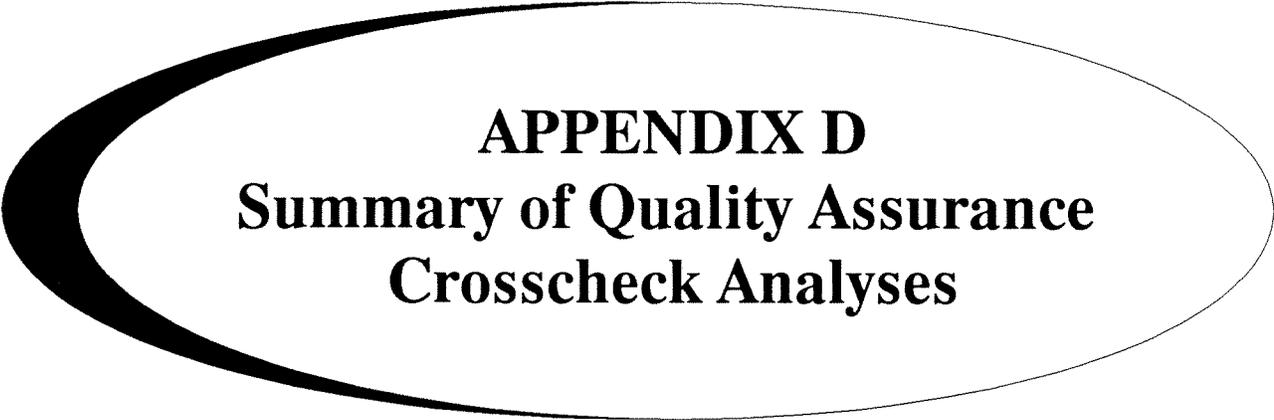


Figure C - 6.4
1990 Cumulative Rainfall Total (inches)



On-screen Review of Tritium Sample Counts



APPENDIX D
Summary of Quality Assurance
Crosscheck Analyses

TABLE D - 1

**Comparison of Radiological Concentrations in Crosscheck Samples
between the West Valley Demonstration Project and the Environmental Measurements Laboratory (EML)
Units for air filters = pCi/filter; soil and vegetation = pCi/g; water = pCi/mL
EML Quality Assessment Program QAP 31¹**

ISOTOPE	Matrix	Reported (WV)	Actual (EML)	Ratio of Rep/Act*	Accept?
Be-7	AIR	1.00E+02	1.23E+02	0.81	YES
Mn-54	AIR	4.00E+00	4.17E+00	0.96	YES
Co-60	AIR	7.70E+00	8.17E+00	0.94	YES
Sr-90	AIR	2.10E-01	2.00E-01	1.05	YES
Cs-134	AIR	7.40E+00	9.33E+00	0.79	PASS
Cs-137	AIR	3.40E+00	3.58E+00	0.95	YES
Ce-144	AIR	7.00E+00	7.08E+00	0.99	YES
Pu-239	AIR	2.10E-01	1.80E-02	11.67	NO
Am-241	AIR	6.00E-02	1.80E-02	3.33	NO
U-238	AIR	2.00E-02	9.00E-03	2.22	NO
K-40	SOIL	5.57E+02	5.61E+02	0.99	YES
Sr-90	SOIL	4.20E+00	5.73E+00	0.73	PASS
Cs-137	SOIL	6.31E+02	6.42E+02	0.98	YES
Pu-239	SOIL	1.61E+01	1.71E+01	0.94	YES
Am-241	SOIL	3.18E+00	2.22E+00	1.43	PASS
U (μg)	SOIL	2.18E+00	1.71E+00	1.27	PASS
K-40	VEG	1.42E+03	1.29E+03	1.10	YES
Sr-90	VEG	7.56E+02	1.83E+03	0.41	NO
Cs-137	VEG	4.65E+01	4.79E+01	0.97	YES
U-238	VEG	4.10E-01	6.00E-01	0.68	PASS
H-3	WATER	3.86E+02	3.95E+02	0.98	YES
Mn-54	WATER	6.65E+01	6.50E+01	1.02	YES
Co-57	WATER	1.35E+02	1.35E+02	1.00	YES
Co-60	WATER	1.55E+02	1.55E+02	1.00	YES
Sr-90	WATER	3.55E+01	3.17E+01	1.12	YES
Cs-134	WATER	5.90E+01	6.83E+01	0.86	YES
Cs-137	WATER	7.05E+01	6.83E+01	1.03	YES
Ce-144	WATER	1.35E+02	1.32E+02	1.02	YES
Pu-239	WATER	2.50E-01	3.50E-01	0.71	PASS
Am-241	WATER	4.30E-01	3.33E-01	1.29	PASS
U-238	WATER	2.20E-01	1.67E-01	1.32	PASS

¹ Analyzed by International Technology Laboratory in December 1989. Results received in 1990.

* Ratio of reported to actual: 1.2 - 0.8 acceptable; 1.5 - 0.5 pass.

TABLE D - 2

**Comparison of Radiological Concentrations in Crosscheck Samples
between the West Valley Demonstration Project and the Environmental Measurements Laboratory (EML)**
Units for air filters = pCi/filter; soil and vegetation = pCi/g; water = pCi/mL
EML Quality Assessment Program (QAP) 32¹

ISOTOPE	Matrix	Reported (WV)	Actual (EML)	Ratio of Rep/Act*	Accept?
Be -7	AIR	4.68E+01	5.14E+01	0.91	YES
Mn-54	AIR	1.01E+01	9.60E+00	1.05	YES
Co -57	AIR	6.52E+00	6.50E+00	1.00	YES
Co -60	AIR	9.27E+00	9.40E+00	0.99	YES
Sr -90	AIR	2.48E-01	2.40E-01	1.03	YES
Cs-134	AIR	1.66E+01	1.82E+01	0.91	YES
Cs -137	AIR	2.05E+01	2.04E+01	1.00	YES
Ce-144	AIR	3.26E+01	3.12E+01	1.04	YES
Pu-239	AIR	3.54E-02	3.90E-02	0.91	YES
Am-241	AIR	5.43E-02	5.40E-02	1.01	YES
U (Nat) ²	AIR	2.20E+00	5.10E-02	43.10	NO
K - 40	SOIL	5.84E+02	6.08E+02	0.96	YES
Sr - 90	SOIL	4.13E+02	6.65E+02	0.62	PASS
Cs -137	SOIL	1.62E+04	1.75E+04	0.93	YES
Pu-239	SOIL	1.87E+02	2.12E+02	0.88	YES
Am-241	SOIL	1.12E+02	1.06E+02	1.06	YES
U (Nat) ²	SOIL	1.20E+01	2.80E+02	0.04	NO
K - 40	VEG	3.34E+02	3.23E+02	1.03	YES
Sr - 90	VEG	7.44E+01	7.02E+01	1.06	YES
Cs -137	VEG	2.79E+01	2.85E+01	0.98	YES
Pu -239	VEG	4.86E-01	3.33E-01	1.46	PASS
Am -241	VEG	1.31E+00	3.07E-01	4.27	NO
U (Nat) ²	VEG	9.68E-02	1.06E+00	0.09	NO
H-3	WATER	1.90E+03	1.96E+03	0.97	YES
Mn -54	WATER	1.07E+02	1.03E+02	1.04	YES
Co -57	WATER	1.95E+02	1.98E+02	0.98	YES
Co - 60	WATER	1.84E+02	2.06E+02	0.89	YES
Sr - 90	WATER	8.29E+01	1.11E+02	0.75	PASS
Cs - 134	WATER	4.17E+02	4.62E+02	0.90	YES
Cs -137	WATER	1.91E+02	1.98E+02	0.96	YES
Ce -144	WATER	4.50E+02	4.03E+02	1.12	YES
Pu -239	WATER	1.21E+00	1.04E+00	1.16	YES
Am - 241	WATER	8.82E-01	8.60E-01	1.03	YES
U - 238	WATER	7.14E-02	1.00E+00	0.07	NO

¹ Analyzed by International Technology.

² Units reported by WVNS as μg ; reported by EML as pCi

* Ratio of reported to actual: 1.2 - 0.8 acceptable; 1.5 - 0.5. pass.

TABLE D - 3

**Comparison of Radiological Concentrations in Crosscheck Samples
between the West Valley Demonstration Project and the Environmental Measurements Laboratory (EML)
Units for air filters = pCi/filter; soil and vegetation = pCi/g; water = pCi/mL
EML Quality Assessment Program (QAP) 33¹**

ISOTOPE	Matrix	Reported (WV)	Actual (EML)	Ratio of Rep/Act*	Accept?
Mn-54	AIR	3.55E+01	3.33E+01	1.07	YES
Co-57	AIR	1.25E+01	1.14E+01	1.10	YES
Co-60	AIR	2.38E+01	2.54E+01	0.94	YES
Sr-90	AIR	1.55E-01	9.30E-02	1.67	NO
Cs-134	AIR	1.71E+01	1.63E+01	1.05	YES
Cs-137	AIR	1.64E+01	1.57E+01	1.04	YES
Ce-144	AIR	1.78E+01	1.65E+01	1.08	YES
Pu-239	AIR	4.65E-02	5.10E-02	0.91	YES
Am-241	AIR	4.35E-02	3.60E-02	1.21	PASS
U (Nat)	AIR	1.14E+00	9.85E-01	1.16	YES
K-40	SOIL	5.45E+02	5.13E+02	1.06	YES
Sr-90	SOIL	6.30E+00	8.33E+00	0.76	PASS
Cs-137	SOIL	2.01E+02	1.96E+02	1.03	YES
Pu-239	SOIL	1.30E+00	1.15E+00	1.13	YES
Am-241	SOIL	1.50E+00	7.38E-01	2.03	NO
U (Nat)	SOIL	2.10E+00	2.19E+00	0.96	YES
K-40	VEG	1.09E+03	1.03E+03	1.06	YES
Sr-90	VEG	7.60E+02	8.89E+02	0.85	YES
Cs-137	VEG	1.90E+01	1.82E+01	1.04	YES
Pu-239	VEG	1.07E-01	9.58E-02	1.12	YES
H-3	WATER	4.24E+03	3.90E+03	1.09	YES
Mn-54	WATER	3.06E+02	3.01E+02	1.02	YES
Co-57	WATER	1.41E+03	1.30E+03	1.08	YES
Co-60	WATER	5.09E+02	4.91E+02	1.04	YES
Sr-90	WATER	1.15E+01	9.93E+00	1.16	YES
Cs-134	WATER	3.63E+02	3.55E+02	1.02	YES
Cs-137	WATER	4.03E+02	3.90E+02	1.03	YES
Ce-144	WATER	9.17E+02	9.23E+02	0.99	YES
Pu-239	WATER	8.70E-01	1.09E+00	0.80	YES
Am-241	WATER	5.50E-01	5.67E-01	0.97	YES
U-238	WATER	2.00E-02	1.89E-02	1.06	YES

¹ Analyzed by International Technology Laboratory.

* Ratio of reported to actual: 1.2 - 0.8 acceptable; 1.5 - 0.5 pass.

TABLE D - 4

**Comparison of Radiological Parameters in pCi/L in Crosscheck Samples
between the West Valley Demonstration Project and the U.S. Environmental Protection Agency's
Environmental Monitoring Systems Laboratory (EMSL) in 1990**

SAMPLE	Analyte	Matrix	Reported (WVDP)	Actual (EMSL)	Accept?*
PE - A (April 1990)	ALPHA	WATER	68.67	90.00	YES
	RA-226	WATER	7.37	5.00	NO
	RA-228	WATER	16.40	10.20	NO
	U (NAT)	WATER	20.67	20.00	YES
PE - B (April 1990)	BETA	WATER	52.33	52.00	YES
	SR-89	WATER	10.67	10.00	YES
	SR-90	WATER	10.67	10.00	YES
	CS-134	WATER	13.67	15.00	YES
	CS-137	WATER	17.00	15.00	YES
PE - A (October 1990)	ALPHA	WATER	52.33	62.00	YES
	RA-226	WATER	11.23	13.60	PASS
	RA-228	WATER	2.97	5.00	PASS
	U (NAT)	WATER	10.67	10.20	YES
PE - B (October 1990)	BETA	WATER	54.00	53.00	YES
	SR-89	WATER	19.67	20.00	YES
	SR-90	WATER	15.00	15.00	YES
	CS-134	WATER	6.67	7.00	YES
	CS-137	WATER	5.33	5.00	YES
GAM (February 1990)	CO-60	WATER	18.00	15.00	YES
	ZN-65	WATER	130.00	139.00	YES
	RU-106	WATER	114.67	139.00	NO
	CS-134	WATER	17.00	18.00	YES
	CS-137	WATER	19.00	18.00	YES
	BA-133	WATER	61.33	74.00	NO
GAM (June 1990)	CO-60	WATER	23.00	24.00	YES
	ZN-65	WATER	132.67	148.00	YES
	RU-106	WATER	167.00	210.00	NO
	CS-134	WATER	20.00	24.00	YES
	CS-137	WATER	22.67	25.00	YES
	BA-133	WATER	78.67	99.00	NO
TRW (February 1990)	H-3	WATER	4599.33	4976.00	YES

Explanation of codes:

ABW: Alpha and beta in water

AF: Air filters

GAM: Gamma in water

NA: Not applicable

NR: Not reported

PE: Performance Evaluation

PE - A: Performance Evaluation (Alpha)

PE - B: Performance Evaluation (Beta)

PUW: Plutonium in water

TRW: Tritium in water

TABLE D - 4 (continued)

**Comparison of Radiological Parameters in pCi/L in Crosscheck Samples
between the West Valley Demonstration Project and the U.S. Environmental Protection Agency's
Environmental Monitoring Systems Laboratory (EMSL) in 1990**

SAMPLE	Analyte	Matrix	Reported (WVDP)	Actual (EMSL)	Accept?*
AF (March 1990)	ALPHA	FILTER	6.00	5.00	YES
	BETA	FILTER	31.67	31.00	YES
	SR-90	FILTER	11.00	10.00	YES
	CS-137	FILTER	12.00	10.00	YES
AF (August 1990)	ALPHA	FILTER	11.00	10.00	YES
	BETA	FILTER	65.00	62.00	YES
	SR-90	FILTER	21.00	20.00	YES
	CS-137	FILTER	21.67	20.00	YES
MILK (April 1990)	SR-89	MILK	NR	23.00	NA
	SR-90	MILK	NR	23.00	NA
	I-131	MILK	109.33	99.00	YES
	CS-137	MILK	23.67	24.00	YES
	TOTAL K	MILK	1650.33	1550.00	PASS
MILK (September 1990)	SR-89	MILK	16.00	16.00	YES
	SR-90	MILK	16.33	20.00	YES
	I-131	MILK	52.00	58.00	YES
	CS-137	MILK	23.00	20.00	YES
	TOTAL K	MILK	1920.00	1700.00	NO
ABW (May 1990)	ALPHA	WATER	12.33	22.00	PASS
	BETA	WATER	16.00	15.00	YES
ABW (September 1990)	ALPHA	WATER	7.00	10.00	YES
	BETA	WATER	10.33	10.00	YES
PUW (August 1990)	PU-239	WATER	7.57	9.10	PASS

Explanation of codes:

ABW: Alpha and beta in water
 AF: Air filters
 GAM: Gamma in water
 NA: Not applicable
 NR: Not reported

PE: Performance Evaluation
 PE - A: Performance Evaluation (Alpha)
 PE - B: Performance Evaluation (Beta)
 PUW: Plutonium in water
 TRW: Tritium in water

* Acceptable range determined by EMSL

TABLE D - 5

**Comparison of Water Quality Parameters in Crosscheck Samples, Study 10,
between the West Valley Demonstration Project and the Environmental Protection Agency (EPA)**

ANALYTE ¹		Reported (WVDP)	Actual (EPA)	Accept?*
AL	($\mu\text{g/L}$)	810	750	YES
AS	($\mu\text{g/L}$)	140	180	PASS
BE	($\mu\text{g/L}$)	190	180	YES
CD	($\mu\text{g/L}$)	120	110	YES
CR	($\mu\text{g/L}$)	640	700	YES
CO	($\mu\text{g/L}$)	280	300	YES
CU	($\mu\text{g/L}$)	510	500	YES
FE**	($\mu\text{g/L}$)	1640	1650	YES
PB	($\mu\text{g/L}$)	160	275	NO
MN	($\mu\text{g/L}$)	600	650	PASS
HG	($\mu\text{g/L}$)	1.3	1.25	YES
NI	($\mu\text{g/L}$)	820	800	YES
SE	($\mu\text{g/L}$)	13	16.0	YES
VA	($\mu\text{g/L}$)	1800	1900	YES
ZN	($\mu\text{g/L}$)	540	550	YES
pH***		8.49	8.50	YES
TSS***	(mg/L)	58.9	60.0	YES
O&G	(mg/L)	8.9	10.0	YES
NH-3***	(mg/L)	10.9	11.0	YES
NO-3	(mg/L)	7.3	06.5	YES
TOC	(mg/L)	20	20.2	YES
BOD-5***	(mg/L)	32.8	33.2	YES
CN	(mg/L)	.75	00.7	YES
PHENOLICS	(mg/L)	.52	00.531	YES

¹ Unless indicated otherwise, analyses performed by RECRA Environmental, Inc.

* Acceptable ranges determined by the Environmental Protection Agency

** Analyzed by WVDP Analytical and Process Chemistry Laboratory

*** Analyzed by WVDP Environmental Laboratory

TABLE D - 6

**Comparison of Water Quality Parameters in Crosscheck Samples between
the West Valley Demonstration Project and the New York State Department of Health (NYSDOH) in 1990**

ANALYTE		Reported (WVDP)	Actual (NYSDOH)	Accept?*
BOD-5	(mg/L)	20.3	20.2	YES
		84.5	82.4	YES
		24.5	24.6	YES
		73.2	72.7	YES
TSS	(mg/L)	33.5	34.2	YES
		70	68.8	YES
		18	18.8	YES
		49.2	47.6	YES
pH		2.93	3.00	YES
		9.45	9.38	YES
		5.38	5.46	PASS
		7.92	7.90	YES
NH-3	(mg/L)	3.05	3.06	YES
		4.18	4.19	YES
		2.07	1.97	YES
		4.17	3.92	YES

* Acceptable range determined by NYSDOH

TABLE D - 7

**Comparison of the West Valley Demonstration Project's Thermoluminescent Dosimeters (TLDs)
to the Co-located Nuclear Regulatory Commission TLDs in 1990**

1ST QTR

NRC TLD#	WVDP TLD#	μ R/hr NRC	μ R/hr WVDP	WVDP/NRC	ACCEPT?
2	22	7.5	8.8	1.17	YES
3	5	7.5	7.9	1.05	YES
4	7	7.0	7.5	1.07	YES
5	9	8.7	6.2	.71	PASS
7	14	8.4	8.1	.96	YES
8	15	8.3	6.9	.83	YES
9	25	15.6	15.9	1.02	YES
11	24	554.2	652.6	1.18	YES

2ND QTR

NRC TLD#	WVDP TLD#	μ R/hr NRC	μ R/hr WVDP	WVDP/NRC	ACCEPT?
2	22	8.6	8.5	.99	YES
3	5	7.8	8.9	1.14	YES
4	7	7.8	8.2	1.05	YES
5	9	10.1	8.1	.80	YES
7	14	N/A	9.8	N/A	N/A
8	15	8.1	8.8	1.09	YES
9	25	17.8	15.6	.88	YES
11	24	582.4	621.4	1.07	YES

3RD QTR

NRC TLD#	WVDP TLD#	μ R/hr NRC	μ R/hr WVDP	WVDP/NRC	ACCEPT?
2	22	7.6	9.6	1.26	PASS
3	5	8.2	10.5	1.27	PASS
4	7	8.3	8.9	1.07	YES
5	9	9.0	9.2	1.02	YES
7	14	8.4	10.7	1.27	PASS
8	15	N/A	9.9	N/A	N/A
9	25	16.6	17.3	1.04	YES
11	24	548.1	617.4	1.13	YES

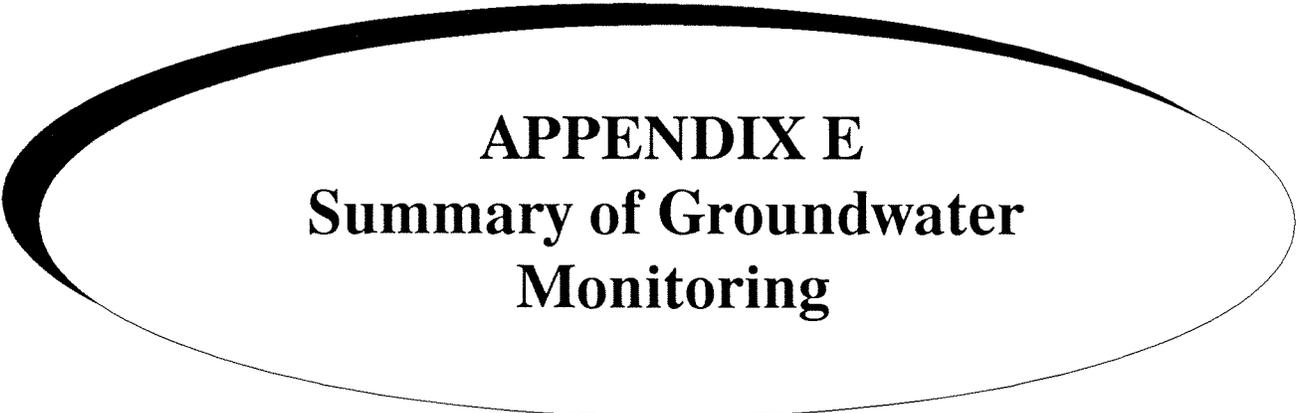
4TH QTR

NRC TLD#	WVDP TLD#	μ R/hr NRC	μ R/hr WVDP	WVDP/NRC	ACCEPT?
2	22	7.3	8.8	1.20	YES
3	5	N/A.	9.5	N/A.	N/A.
4	7	7.6	8.7	1.14	YES
5	9	9.7	8.7	.90	YES
7	14	7.3	9.5	1.31	PASS
8	15	7.2	9.4	1.30	PASS
9	25	15.8	15.3	.97	YES
11	24	N/A	622.4	N/A	N/A

* Ratio of reported to actual: 1.2-0.8 acceptable; 1.5-0.5 pass
N/A Not available



Checking a Total Organic Carbon Analyzer Run



APPENDIX E
Summary of Groundwater
Monitoring

TABLE E-1

Supporting Groundwater Monitoring Stations Sampled in 1990 ($\mu\text{Ci/mL}$)

Location Code	Date Sampled	pH	Conductivity ¹	Alpha	Beta	H-3	Cs-137	Co-60
Wells Near Site Facilities								
WNW80-03	06/20/90	6.83	546	< 3.19E-09	2.41±.13E-07	1.37±1.13E-07	< 3.7E-08	< 3.8E-08
WNW80-03	11/08/90	7.10	450	< 2.80E-09	1.61±.08E-07	< 1.10E-07	< 3.7E-08	< 3.8E-08
WNW80-04	06/20/90	7.03	560	< 3.01E-09	1.72±.32E-08	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW80-04	11/08/90	7.20	816	< 1.29E-08	3.24±.45E-08	< 1.00E-07	< 3.7E-08	< 3.8E-08
Wells Near NRC-licensed Disposal Unit								
WNW82-1A	06/20/90	7.15	1291	< 9.89E-09	9.34±5.15E-09	< 1.10E-07	< 3.7E-08	< 3.8E-08
WNW82-1A	12/06/90	7.24	1139	1.52±.90E-08	3.79±3.56E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW82-1B	06/20/90	7.02	1315	< 1.19E-08	1.11±.43E-08	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW82-1B	12/06/90	7.39	1168	< 4.52E-09	6.79±3.84E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW82-1C	06/22/90	7.78	382	8.91±7.56E-09	7.46±4.68E-09	1.75±1.14E-07	< 3.7E-08	< 3.8E-08
WNW82-1C	12/06/90	7.74	357	< 5.94E-09	< 6.27E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW82-2B	06/22/90	7.32	742	4.82±2.94E-08	9.30±4.45E-09	2.80±1.17E-07	< 3.7E-08	< 3.8E-08
WNW82-2B	12/06/90	7.60	736	1.21±1.18E-08	1.39±.76E-08	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW82-2C	*****	*****	Sample Location Was Dry			*****		
WNW82-2C	12/06/90	*****	Limited Sample Volume		*****	< 1.00E-07	*****	
WNW82-3A	***** Sample Location Was Dry *****							
WNW82-3A	12/06/90	7.59	536	3.13±2.75E-09	8.69±2.60E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW82-4A1	06/20/90	6.79	1433	< 1.22E-08	< 4.89E-09	7.50±.22E-05	< 3.7E-08	< 3.8E-08
WNW82-4A1	12/07/90	6.71	1390	1.40±1.04E-08	1.09±.55E-08	8.43±.25E-05	< 3.7E-08	< 3.8E-08
WNW82-4A2	06/20/90	6.75	1239	< 1.20E-08	< 5.24E-09	< 1.14E-07	< 3.7E-08	< 3.8E-08
WNW82-4A2	12/07/90	6.87	1316	1.32±1.15E-08	4.81±4.62E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW82-4A3	06/20/90	6.69	1456	< 1.93E-08	< 4.98E-09	1.45±1.12E-07	< 3.7E-08	< 3.8E-08
WNW82-4A3	12/07/90	6.84	1367	< 3.07E-09	< 4.87E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08

¹ Measured in $\mu\text{mhos/cm}$ @ 25°C

TABLE E - 2

1990 Fuel Tank Groundwater Monitoring

PARAMETER	WNW86-13	WNW86-13	WNW86-13
	<i>(Sample date: 2-5-90)</i>	<i>(Sample date: 4-12-90)</i>	<i>(Sample date: 10-11-90)</i>
pH	6.97	7.20	7.22
Conductivity (μmhos/cm)	639	580	588
TOC (mg/L)	2.00	1.70	3.40
Phenols (mg/L)	< .007	< .005	.010
Benzene (μg/L)	< 5.00	< 5.00	< 0.40
Toluene (μg/L)	< 5.00	< 5.00	< 0.20
Xylene –total (μg/L)	< 5.00	< 5.00	N/A
o-xylene (μg/L)	N/A	N/A	< 0.20
m-xylene (μg/L)	N/A	N/A	< 0.20
p-xylene (μg/L)	N/A	N/A	< 0.20
H-3 (μCi/mL)	< 1.00E-07	< 1.00E-07	2.12 \pm 1.15E-07
Alpha (μCi/mL)	< 4.44E-09	< 2.24E-09	< 4.28E-09
Beta (μCi/mL)	3.57 \pm 2.26E-09	3.71 \pm 1.64E-09	5.46 \pm 2.09E-09

N/A - Not available

TABLE E - 3

1990 Water Quality Parameters for the High-level Waste Storage and Processing Area (mg/L)

Location Code	Hydraulic Position	Sample Date	pH	Conductivity ²	TOC	Phenols	TOH	Chloride	Nitrate-N	Sulfate	Fluoride
***Quality Standards ¹ ***			6.5-8.5	N/A	N/A	.001	N/A	250	10	250	1.5
WNW80-02	UP	02/05/90	8.45	422	1.3	<.008	<.010	55.0	.51	12.0	<.10
WNW80-02	UP	04/12/90	7.71	466	< 1.0	<.005	<.010	57.0	.50	34.0	<.10
WNW80-02	UP	06/05/90	7.64	493	< 1.0	<.007	<.005	65.5	.51	16.8	<.10
WNW80-02	UP	06/14/90	7.81	503	1.40	<.007	<.005	63.5	.91	19.4	<.10
WNW80-02	UP	09/10/90	7.69	434	N/A	<.006	<.005	57.6	.37	12.3	.10
WNW80-02	UP	09/26/90	7.69	450	1.50	<.008	<.005	60.0	.51	38.7	<.10
WNW80-02	UP	10/24/90	7.74	465	< 1.0	<.009	<.005	65.3	.77	43.0	<.10
WNW80-02	UP	11/07/90	7.59	479	< 1.0	<.005	.007	61.4	.72	14.5	<.10
WNDMPNE ³	DOWN	02/06/90	6.62	602	6.5	<.008	<.010	39.0	.51	58.0	<.10
WNDMPNE	DOWN	04/12/90	6.55	452	5.2	<.005	<.010	22.0	.77	40.0	<.10
WNDMPNE	DOWN	05/31/90	6.79	618	3.8	<.008	.020	69.0	1.20	34.0	<.10
WNDMPNE	DOWN	06/15/90	6.62	721	3.7	<.008	.007	93.8	1.20	33.4	.11
WNDMPNE	DOWN	09/12/90	6.72	661	5.1	.130	.012	67.0	.73	20.4	.12
WNDMPNE	DOWN	09/27/90	6.73	679	5.6	<.008	.025	64.7	1.10	198	<.10
WNDMPNE	DOWN	10/25/90	6.57	611	6.1	<.009	.017	45.0	.44	27.2	<.10
WNDMPNE	DOWN	11/12/90	6.60	494	5.3	<.008	.007	28.9	.55	23.5	<.10
WNW86-07	DOWN	02/12/90	6.08	748	< 1.0	<.008	<.010	70.0	1.20	130	<.10
WNW86-07	DOWN	04/09/90	6.07	686	1.3	<.008	.010	38.0	.68	140	<.10
WNW86-07	DOWN	05/24/90	6.43	723	2.3	<.020	.097	31.3	.78	120	<.10
WNW86-07	DOWN	06/15/90	6.38	560	1.9	<.008	.007	27.5	1.60	135	<.10
WNW86-07	DOWN	07/30/90	6.10	674	1.1	<.009	<.005	22.4	1.60	144	<.10
WNW86-07	DOWN	09/24/90	5.96	645	1.7	<.008	<.005	22.8	.18	141	<.10
WNW86-07	DOWN	10/24/90	6.07	536	1.1	<.020	.007	15.4	.67	108	<.10
WNW86-07	DOWN	11/07/90	6.14	560	< 1.0	.021	.006	12.2	.64	131	<.10

¹ Quality standards for Class GA groundwater are from 6 NYCRR Part 703.5

² Measured in μ mhos/cm at 25°C

³ Monitors the construction and demolition debris landfill (CDDL)

N/A - Not available

TABLE E - 3 (continued)

1990 Water Quality Parameters for the High-level Waste Storage and Processing Area (mg/L)

Location Code	Hydraulic Position	Sample Date	pH	Conductivity ²	TOC	Phenols	TOH	Chloride	Nitrate-N	Sulfate	Fluoride
Quality Standards¹			6.5-8.5	N/A	N/A	.001	N/A	250	10	250	1.5
WNW86-08	DOWN	02/12/90	6.66	533	5.3	<.008	<.010	31.0	.23	160	.12
WNW86-08	DOWN	04/12/90	6.94	483	7.1	<.005	<.010	13.0	.098	79	<.10
WNW86-08	DOWN	05/24/90	6.58	449	8.2	<.007	<.005	9.9	.23	110	.11
WNW86-08	DOWN	06/15/90	6.80	290	13.7	<.008	.006	10.2	.14	75	.14
WNW86-08	DOWN	07/30/90	6.50	611	5.9	<.010	.005	15.7	.21	144	<.10
WNW86-08	DOWN	09/24/90	6.63	589	6.7	<.008	.009	15.0	.20	131	.13
WNW86-08	DOWN	10/24/90	6.73	517	6.3	<.020	.023	11.3	.12	164	.13
WNW86-08	DOWN	11/07/90	6.82	529	4.2	<.009	.030	10.0	.10	278	.11
WNW86-09	DOWN	02/12/90	7.20	634	<1.0	<.008	<.010	32.0	1.90	28.0	<.10
WNW86-09	DOWN	04/12/90	7.06	630	5.9	<.005	.010	33.0	3.50	34.0	<.10
WNW86-09	DOWN	05/24/90	7.17	640	4.6	<.020	.021	35.0	.11	67.2	<.10
WNW86-09	DOWN	06/15/90	7.24	640	3.1	<.007	.016	40.7	.14	98.5	<.10
WNW86-09	DOWN	07/26/90	7.16	649	6.8	.015	.014	44.0	1.70	21.9	<.10
WNW86-09	DOWN	09/27/90	7.00	525	1.6	<.008	.013	24.8	.32	27.8	<.10
WNW86-09	DOWN	10/24/90	7.16	690	1.9	<.008	.019	47.3	2.90	47.2	<.10
WNW86-09	DOWN	11/07/90	7.10	697	1.2	<.009	.015	43.0	4.00	13.4	<.10
WNW86-12	DOWN	03/08/90	7.50	694	2.8	<.008	<.010	50.0	<.05	60.0	<.10
WNW86-12	DOWN	04/26/90	7.75	712	<1.0	<.008	<.010	50.0	<.05	63.0	<.10
WNW86-12	DOWN	05/31/90	7.32	707	<1.0	<.007	.011	49.0	.059	120	<.10
WNW86-12	DOWN	06/15/90	7.36	706	1.3	<.008	.005	53.6	.21	67.8	<.10
WNW86-12	DOWN	09/10/90	7.24	713	N/A	.005	.017	59.8	.066	57.0	.06
WNW86-12	DOWN	09/27/90	7.30	724	<1.0	<.008	<.005	60.0	.092	30.4	<.10
WNW86-12	DOWN	10/25/90	7.41	726	<1.0	<.010	.018	62.3	.050	60.2	<.10
WNW86-12	DOWN	11/08/90	7.31	730	<1.0	<.008	.010	58.0	<.050	65.2	<.10

¹ Quality standards for Class GA groundwater are from 6 NYCRR Part 703.5

² Measured in μ mhos/cm at 25°C

³ Monitors the construction and demolition debris landfill (CDDL)

N/A - Not available

TABLE E - 4

1990 Total Metals for the High-level Waste Storage and Processing Area (mg/L)

Location Code	Hydraulic Sample Position	Arsenic Date	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Silver	Sodium
Quality Standards¹			.025	1.0	.01	.05	.30	.025	.30	.002	.01	.05 <20
WNW80-02	UP	02/05/90	<.005	<.05	.005	.016	9.3	.009	.076	<.0004	<.005	<.010 2.2
WNW80-02	UP	04/12/90	<.005	.10	<.005	<.010	3.3	<.005	.078	.0005	<.005	<.010 4.9
WNW80-02	UP	06/05/90	<.005	.10	.006	.016	1.7	<.005	.038	<.0004	<.005	<.010 4.7
WNW80-02	UP	06/14/90	<.005	<.08	.010	<.010	1.2	<.005	.036	<.0004	<.005	<.010 3.9
WNW80-02	UP	09/10/90	<.005	.17	<.005	<.010	.98	.003	.030	<.0004	<.005	<.005 <5.0
WNW80-02	UP	09/26/90	<.005	.099	<.005	<.010	4.2	.013	.079	<.0004	<.005	<.005 4.5
WNW80-02	UP	10/24/90	<.005	.10	.009	<.010	3.3	.009	.066	.0012	<.005	<.006 11.3
WNW80-02	UP	11/07/90	<.005	.10	<.005	<.010	8.9	.026	.084	<.0004	<.005	<.005 5.6
WNDMPNE ²	DOWN	02/06/90	<.005	.11	<.005	.014	6.7	.006	.33	<.0004	<.005	<.010 11.0
WNDMPNE	DOWN	04/12/90	<.005	.05	<.005	<.010	4.0	<.005	.34	<.0004	<.005	<.010 9.0
WNDMPNE	DOWN	05/31/90	<.005	.09	.005	.014	.10	<.005	.018	<.0004	<.005	<.010 19.0
WNDMPNE	DOWN	06/15/90	<.005	.08	<.005	<.010	.07	<.005	.015	<.0004	<.005	<.010 19.4
WNDMPNE	DOWN	09/12/90	<.005	.12	.005	<.010	2.8	<.003	.095	<.0004	<.005	<.005 26.5
WNDMPNE	DOWN	09/27/90	<.005	.11	<.005	<.010	3.5	.003	.23	<.0004	<.005	<.005 24.2
WNDMPNE	DOWN	10/25/90	<.005	<.15	<.005	<.010	3.2	.016	.20	<.0004	<.005	<.006 13.6
WNDMPNE	DOWN	11/12/90	<.005	<.15	.007	<.010	.33	<.003	.19	<.0004	<.005	<.006 14.0
WNW86-07	DOWN	02/12/90	.036	<.06	.008	<.010	.21	<.005	.64	<.0004	<.005	<.005 17.0
WNW86-07	DOWN	04/09/90	<.005	<.05	.006	<.010	.31	<.005	.57	<.0004	<.005	<.010 16.0
WNW86-07	DOWN	05/24/90	<.005	.10	<.005	.013	2.6	<.005	.45	<.0004	<.005	<.010 12.5
WNW86-07	DOWN	06/15/90	<.005	.05	.007	<.010	1.4	<.005	.36	<.0004	<.005	<.010 10.8
WNW86-07	DOWN	07/30/90	<.005	<.07	<.005	<.010	.24	.005	.35	<.0004	<.005	<.010 12.6
WNW86-07	DOWN	09/24/90	<.005	<.05	<.005	<.010	.14	<.003	.29	<.0004	<.005	<.005 21.6
WNW86-07	DOWN	10/24/90	<.005	<.05	.008	<.010	.25	<.003	.41	<.0004	<.005	.007 40.8
WNW86-07	DOWN	11/07/90	<.005	<.05	<.005	<.010	.31	.010	.61	<.0004	<.005	<.005 19.2

¹ Quality standards for Class GA groundwater are from 6 NYCRR Part 703.5

² Monitors the construction and demolition debris landfill (CDDL)

N/A - Not available

TABLE E - 4 (continued)

1990 Total Metals for the High-level Waste Storage and Processing Area (mg/L)

Location Code	Hydraulic Position	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Silver	Sodium
<i>***Quality Standards¹***</i>			.025	1.0	.01	.05	.30	.025	.30	.002	.01	.05	<20
WNW86-08	DOWN	02/12/90	.043	.28	.010	.013	24.0	.670	8.3	<.0004	<.005	<.005	19.0
WNW86-08	DOWN	04/12/90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WNW86-08	DOWN	05/24/90	.011	.15	<.005	.017	15.4	.015	5.8	<.0004	<.005	<.010	7.5
WNW86-08	DOWN	06/15/90	.029	.29	.011	.038	55.4	.034	7.1	<.0004	<.005	<.010	7.5
WNW86-08	DOWN	07/30/90	<.005	.11	<.005	<.010	0.85	.005	8.0	<.0004	<.005	<.010	10.2
WNW86-08	DOWN	09/24/90	<.005	.14	<.005	<.010	3.4	.011	6.8	<.0004	<.005	<.005	13.8
WNW86-08	DOWN	10/24/90	.012	.16	.009	.014	19.6	.022	9.9	.0008	<.005	.007	25.1
WNW86-08	DOWN	11/07/90	<.005	.21	.011	.022	31.1	.024	9.4	<.0004	<.005	<.005	11.2
WNW86-09	DOWN	02/12/90	.029	.27	.014	<.010	10.0	.012	.29	<.0004	<.005	<.005	8.9
WNW86-09	DOWN	04/12/90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WNW86-09	DOWN	05/24/90	.010	.35	<.005	.030	21.9	.022	.68	<.0004	<.005	<.010	7.4
WNW86-09	DOWN	06/15/90	<.005	.19	.010	<.010	<.05	.009	<.005	<.0004	<.005	<.010	6.8
WNW86-09	DOWN	07/26/90	.015	.24	<.010	<.010	10.5	<.005	.34	<.0004	<.005	<.007	9.4
WNW86-09	DOWN	09/27/90	<.005	.21	<.005	<.010	4.0	.006	.13	<.0004	<.005	<.005	9.8
WNW86-09	DOWN	10/24/90	<.005	.23	.008	<.010	8.8	.008	.24	.0020	<.005	<.006	22.7
WNW86-09	DOWN	11/07/90	<.005	.21	.010	<.010	2.2	.006	.071	<.0004	<.005	<.005	10.5
WNW86-12	DOWN	03/08/90	<.005	.33	.012	<.010	2.1	<.005	.11	<.0004	<.005	<.005	12.0
WNW86-12	DOWN	04/26/90	<.005	.35	.010	<.010	1.5	<.005	.11	<.0004	<.005	<.005	12.0
WNW86-12	DOWN	05/31/90	<.005	.39	<.005	<.010	0.67	<.005	.099	<.0004	<.005	<.010	10.0
WNW86-12	DOWN	06/15/90	.015	.31	<.005	<.010	11.0	.005	.25	<.0004	<.005	<.010	8.90
WNW86-12	DOWN	09/10/90	.005	.49	<.005	<.010	2.6	<.003	.12	<.0004	<.005	<.005	13.0
WNW86-12	DOWN	09/27/90	<.005	.39	<.005	<.010	0.92	<.003	.11	<.0004	<.005	<.005	12.1
WNW86-12	DOWN	10/25/90	<.005	.45	.006	<.010	1.9	<.003	.11	<.0004	<.005	<.006	12.4
WNW86-12	DOWN	11/08/90	<.005	.44	.009	<.010	1.3	.015	.10	<.0004	<.005	<.005	11.0

¹ Quality standards for Class GA groundwater are from 6 NYCRR Part 703.5

² Monitors the construction and demolition debris landfill (CDDL)

N/A - Not available

TABLE E - 5

1990 Dissolved Metals for the High-level Waste Storage and Processing Area (mg/L)

Location Code	Hydraulic Sample Position	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Silver	Sodium	
Quality Standards^{1*}		.025	1.0	.01	.05	.30	.025	.30	.002	.01	.05	<20	
WNW80-02	UP	02/05/90	<.005	.07	<.005	<.020	<.05	<.005	.014	<.0004	<.005	<.010	2.1
WNW80-02	UP	04/12/90	<.005	.06	<.005	<.010	<.05	<.005	.010	.0005	<.005	<.010	5.3
WNW80-02	UP	06/05/90	<.005	.10	<.005	<.010	<.05	<.005	.020	<.0004	<.005	<.010	4.8
WNW80-02	UP	06/14/90	<.005	.10	<.005	<.010	<.05	<.005	.006	<.0004	<.005	<.010	4.5
WNW80-02	UP	09/10/90	<.005	.13	<.005	<.010	<.05	<.003	.005	<.0004	<.005	<.005	<5.0
WNW80-02	UP	09/26/90	<.005	.09	<.005	<.010	<.02	<.003	.014	<.0004	<.005	<.005	4.4
WNW80-02	UP	10/24/90	<.005	.10	<.005	<.010	<.05	<.003	.011	<.0004	<.005	<.005	2.6
WNW80-02	UP	11/07/90	<.005	.096	<.005	<.010	<.02	<.003	.013	<.0004	<.005	<.005	4.9
WNDMPNE ²	DOWN	02/06/90	<.005	.09	<.005	.011	<.05	<.005	.085	<.0004	<.005	<.010	12.0
WNDMPNE	DOWN	04/12/90	<.005	.05	<.005	<.010	<.05	<.005	.017	<.0004	<.005	<.010	9.1
WNDMPNE	DOWN	05/31/90	<.005	.07	.005	<.010	<.05	<.005	.012	<.0004	<.005	<.010	21.0
WNDMPNE	DOWN	06/15/90	<.005	.11	<.005	<.010	<.05	<.005	.016	<.0004	<.005	<.010	26.8
WNDMPNE	DOWN	09/12/90	<.005	.10	<.005	<.010	.10	<.003	.084	<.0004	<.005	<.005	25.2
WNDMPNE	DOWN	09/27/90	<.005	.092	<.005	<.010	<.02	<.003	.022	<.0004	<.005	<.005	23.7
WNDMPNE	DOWN	10/25/90	<.005	<.10	<.005	<.010	<.05	<.003	.071	<.0004	<.005	<.006	16.0
WNDMPNE	DOWN	11/12/90	<.005	<.15	<.005	<.010	.05	<.003	<.007	<.0004	<.005	<.006	12.9
WNW86-07	DOWN	02/12/90	.012	<.06	<.005	<.010	<.03	<.005	.58	<.0004	<.005	<.005	19.0
WNW86-07	DOWN	04/09/90	<.005	<.05	<.005	<.010	<.05	<.005	.42	<.0004	<.005	<.010	17.0
WNW86-07	DOWN	05/24/90	<.005	<.06	<.005	.010	.91	<.005	.39	<.0004	<.005	<.010	13.7
WNW86-07	DOWN	06/15/90	<.005	<.05	<.005	<.010	<.05	<.005	.012	<.0004	<.005	<.010	14.8
WNW86-07	DOWN	07/30/90	<.005	<.05	<.005	.016	<.05	<.005	.045	<.0004	<.005	<.010	13.5
WNW86-07	DOWN	09/24/90	<.005	<.05	<.005	<.010	<.02	<.003	.24	<.0004	<.005	<.005	20.0
WNW86-07	DOWN	10/24/90	<.005	.06	<.005	<.010	<.05	<.003	.26	<.0004	<.005	<.005	16.6
WNW86-07	DOWN	11/07/90	<.005	<.05	<.005	<.010	<.02	<.003	.43	<.0004	<.005	<.005	18.7

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

² Monitors the construction and demolition debris landfill (CDDL)

N/A - Not available

TABLE E - 5 (continued)

1990 Dissolved Metals for the High-level Waste Storage and Processing Area(mg/L)

Location Code	Hydraulic Position	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Silver	Sodium
Quality Standards¹*			.025	1.0	.01	.05	.30	.025	.30	.002	.01	.05	< 20
WNW86-08	DOWN	02/12/90	.042	.090	<.005	<.010	1.000	<.005	8.200	<.0004	<.005	<.005	15.0
WNW86-08	DOWN	04/12/90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WNW86-08	DOWN	05/24/90	<.005	<.060	<.005	.014	.510	<.005	5.800	<.0004	<.005	<.010	8.9
WNW86-08	DOWN	06/15/90	<.005	.060	<.005	<.010	.300	<.005	7.000	<.0004	<.005	<.010	9.4
WNW86-08	DOWN	07/30/90	<.005	.110	<.005	<.010	.810	<.005	7.900	<.0004	<.005	<.010	11.8
WNW86-08	DOWN	09/24/90	<.005	.094	<.005	<.010	.400	<.003	7.000	<.0004	<.005	<.005	13.5
WNW86-08	DOWN	10/24/90	<.005	.100	<.005	<.010	.500	<.003	9.000	.0009	<.005	<.005	9.3
WNW86-08	DOWN	11/07/90	<.005	.090	<.005	<.010	.160	<.003	5.300	<.0004	<.005	<.005	10.9
WNW86-09	DOWN	02/12/90	<.005	.095	<.005	<.010	.050	<.005	.010	<.0004	<.005	<.005	9.0
WNW86-09	DOWN	04/12/90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WNW86-09	DOWN	05/24/90	<.005	.170	<.005	.015	.050	<.005	.011	<.0004	<.005	<.010	7.4
WNW86-09	DOWN	06/15/90	<.005	.160	<.005	<.010	.050	<.005	.005	<.0004	<.005	<.010	8.9
WNW86-09	DOWN	07/26/90	<.005	.160	<.010	<.010	.050	<.005	.019	<.0004	<.005	<.007	9.9
WNW86-09	DOWN	09/27/90	<.005	.200	<.005	<.010	.020	<.003	.012	<.0004	<.005	<.005	9.3
WNW86-09	DOWN	10/24/90	<.005	.210	<.005	<.010	.050	<.003	.013	<.0004	<.005	<.005	7.6
WNW86-09	DOWN	11/07/90	<.005	.210	<.005	<.010	.020	<.003	.008	<.0004	<.005	<.005	10.0
WNW86-12	DOWN	03/08/90	<.005	.350	<.005	<.010	.290	<.005	.091	<.0004	<.005	<.005	11.0
WNW86-12	DOWN	04/26/90	<.005	.380	<.005	<.010	.360	<.005	.088	<.0004	<.005	<.005	15.0
WNW86-12	DOWN	05/31/90	<.005	.330	<.005	<.010	.330	<.005	.077	<.0004	<.005	<.010	11.0
WNW86-12	DOWN	06/15/90	<.005	.320	<.005	<.010	.390	<.005	.094	<.0004	<.005	<.010	11.8
WNW86-12	DOWN	09/10/90	<.005	.450	<.005	<.010	.430	<.003	.093	<.0004	<.005	<.005	12.0
WNW86-12	DOWN	09/27/90	<.005	.410	<.005	<.010	.450	<.003	.100	<.0004	<.005	<.005	12.0
WNW86-12	DOWN	10/25/90	<.005	.320	<.005	<.010	.390	<.003	.099	<.0004	<.005	<.006	12.9
WNW86-12	DOWN	11/08/90	<.005	.310	<.005	<.010	.320	<.003	.079	<.0004	<.005	<.005	11.7

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

² Monitors the construction and demolition debris landfill (CDDL)

N/A - Not available

TABLE E - 6

1990 Radioactivity Concentrations for the High-level Waste Storage and Processing Area ($\mu\text{Ci}/\text{mL}$)

Location Code	Hydraulic Position	Sample Date	Gross Alpha	Gross Beta	Tritium	Cs-137	Co-60
*****Department of Energy DCGs*****			3.0E-08	1.0E-06	2.0E-03	3.0E-06	5.0E-06
*****Quality Standards ¹ *****			1.5E-08	1.0E-06	2.0E-05	N/A	N/A
WNW80-02	UP	02/05/90	< 8.32E-10	< 1.70E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW80-02	UP	04/12/90	< 1.98E-09	< 1.10E-09	< 1.09E-07	< 3.7E-08	< 3.8E-08
WNW80-02	UP	06/05/90	< 4.06E-09	< 1.67E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW80-02	UP	06/14/90	< 3.31E-09	< 1.66E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW80-02	UP	09/10/90	< 1.72E-09	< 1.55E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW80-02	UP	09/26/90	< 1.23E-09	< 1.08E-09	2.99±1.14E-07	< 3.7E-08	< 3.8E-08
WNW80-02	UP	10/24/90	< 1.36E-09	2.48±1.72E-09	2.13±1.13E-07	< 3.7E-08	< 3.8E-08
WNW80-02	UP	11/07/90	< 1.30E-09	< 1.37E-09	< 9.84E-08	< 3.7E-08	< 3.8E-08
WNDMPNE ²	DOWN	02/06/90	< 1.25E-09	8.01±.57E-08	4.54±1.21E-07	< 3.7E-08	< 3.8E-08
WNDMPNE	DOWN	04/12/90	< 9.88E-10	3.71±.37E-08	2.69±1.16E-07	< 3.7E-08	< 3.8E-08
WNDMPNE	DOWN	05/31/90	< 4.94E-09	1.35±.07E-07	7.47±1.30E-07	< 3.7E-08	< 3.8E-08
WNDMPNE	DOWN	06/15/90	8.31±7.28E-09	1.48±.08E-07	1.13±.14E-06	< 3.7E-08	< 3.8E-08
WNDMPNE	DOWN	09/12/90	< 3.81E-09	1.33±.07E-07	8.23±1.29E-07	< 3.7E-08	< 3.8E-08
WNDMPNE	DOWN	09/27/90	< 3.49E-09	1.64±.08E-07	5.90±1.22E-07	< 3.7E-08	< 3.8E-08
WNDMPNE	DOWN	10/25/90	< 3.56E-09	1.54±.30E-08	6.04±1.25E-07	< 3.7E-08	< 3.8E-08
WNDMPNE	DOWN	11/12/90	< 4.22E-09	5.93±.51E-08	5.32±1.21E-07	< 3.7E-08	< 3.8E-08
WNW86-07	DOWN	02/12/90	< 1.56E-09	3.62±2.18E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-07	DOWN	04/09/90	< 2.37E-09	4.33±1.72E-09	< 1.13E-07	< 3.7E-08	< 3.8E-08
WNW86-07	DOWN	05/24/90	< 2.82E-09	4.96±2.00E-09	< 1.17E-07	< 3.7E-08	< 3.8E-08
WNW86-07	DOWN	06/15/90	< 3.70E-09	4.41±2.14E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-07	DOWN	07/30/90	< 5.53E-09	4.46±2.10E-09	2.65±1.13E-07	< 3.7E-08	< 3.8E-08
WNW86-07	DOWN	09/24/90	< 2.65E-09	2.74±.35E-08	1.24±1.11E-07	< 3.7E-08	< 3.8E-08
WNW86-07	DOWN	10/24/90	< 2.24E-09	6.96±.52E-08	1.60±1.12E-07	< 3.7E-08	< 3.8E-08
WNW86-07	DOWN	11/07/90	< 1.38E-09	1.15±.25E-08	< 1.00E-07	< 3.7E-08	< 3.8E-08

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

² Monitors construction and demolition debris landfill (CDDL)

N/A - Not available

Note: Gross alpha DCG as Am-241; gross beta DCG as Sr-90

TABLE E - 6 (continued)

1990 Radioactivity Concentrations in the High-level Waste Storage and Processing Area ($\mu\text{Ci/mL}$)

Location Code	Hydraulic Position	Sample Date	Gross Alpha	Gross Beta	Tritium	Cs-137	Co-60
****Department of Energy DCGs ****			3.0E-08	1.0E-06	2.0E-03	3.0E-06	5.0E-06
****Quality Standards ¹ ****			1.5E-08	1.0E-06	2.0E-05	N/A	N/A
WNW86-08	DOWN	02/12/90	< 3.70E-09	8.07±2.57E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-08	DOWN	04/12/90	< 1.15E-09	7.13±1.92E-09	1.74±1.20E-07	< 3.7E-08	< 3.8E-08
WNW86-08	DOWN	05/24/90	< 1.39E-09	9.02±2.18E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-08	DOWN	06/15/90	< 1.32E-09	8.79±2.34E-09	6.46±1.26E-07	< 3.7E-08	< 3.8E-08
WNW86-08	DOWN	07/30/90	< 4.41E-09	1.44±.29E-08	5.23±1.24E-07	< 3.7E-08	< 3.8E-08
WNW86-08	DOWN	09/24/90	< 3.51E-09	1.39±.28E-08	2.95±1.47E-07	< 3.7E-08	< 3.8E-08
WNW86-08	DOWN	10/24/90	< 1.77E-09	8.91±2.35E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-08	DOWN	11/07/90	2.99±2.76E-09	8.58±2.27E-09	2.72±1.38E-07	< 3.7E-08	< 3.8E-08
WNW86-09	DOWN	02/12/90	< 6.44E-09	2.08±.09E-07	1.94±.16E-06	< 3.7E-08	< 3.8E-08
WNW86-09	DOWN	04/12/90	< 3.87E-09	2.04±.09E-07	1.65±.15E-06	< 3.7E-08	< 3.8E-08
WNW86-09	DOWN	05/24/90	< 5.36E-09	1.70±.12E-07	2.04±.16E-06	< 3.7E-08	< 3.8E-08
WNW86-09	DOWN	06/15/90	5.48±5.37E-09	2.45±.10E-07	1.92±.16E-06	< 3.7E-08	< 3.8E-08
WNW86-09	DOWN	07/26/90	< 5.85E-09	2.71±.11E-07	2.15±.16E-06	< 3.7E-08	< 3.8E-08
WNW86-09	DOWN	09/27/90	< 2.73E-09	2.51±.07E-07	2.05±.16E-06	< 3.7E-08	< 3.8E-08
WNW86-09	DOWN	10/24/90	< 2.75E-09	2.31±.10E-07	2.01±.15E-06	< 3.7E-08	< 3.8E-08
WNW86-09	DOWN	11/07/90	< 7.87E-09	3.00±.11E-07	1.50±.14E-06	< 3.7E-08	< 3.8E-08
WNW86-12	DOWN	03/08/90	< 5.00E-09	1.68±1.45E-09	2.46±.17E-06	< 3.7E-08	< 3.8E-08
WNW86-12	DOWN	04/26/90	< 7.18E-09	< 1.91E-09	3.09±.19E-06	< 3.7E-08	< 3.8E-08
WNW86-12	DOWN	05/31/90	< 5.45E-09	< 1.87E-09	3.02±.19E-06	< 3.7E-08	< 3.8E-08
WNW86-12	DOWN	06/15/90	< 3.60E-09	< 1.84E-09	3.18±1.20E-06	< 3.7E-08	< 3.8E-08
WNW86-12	DOWN	09/10/90	9.28±6.43E-09	< 1.96E-09	2.62±.17E-06	< 3.7E-08	< 3.8E-08
WNW86-12	DOWN	09/27/90	< 5.80E-09	2.10±2.01E-09	2.93±.18E-06	< 3.7E-08	< 3.8E-08
WNW86-12	DOWN	10/25/90	< 2.77E-09	< 1.80E-09	2.81±.18E-06	< 3.7E-08	< 3.8E-08
WNW86-12	DOWN	11/08/90	< 6.90E-09	< 1.70E-09	2.80±.18E-06	< 3.7E-08	< 3.8E-08

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

² Monitors construction and demolition debris landfill (CDDL)

N/A - Not available

Note: Gross alpha DCG as Am-241; gross beta DCG as Sr-90

TABLE E - 7

1990 Water Quality Parameters for the Low-level Liquid Waste Treatment Facility (mg/L)

Location Code	Hydraulic Position	Sample Date	pH	Conductivity ²	TOC	Phenols	TOH	Chloride	Nitrate-N	Sulfate	Fluoride
*** Quality Standards ¹ ***			6.5-8.5	N/A	N/A	.001	N/A	250	10	250	1.5
WNW86-06	UP	03/08/90	6.88	1519	1.2	< .008	.020	320	.33	46.0	.11
WNW86-06	UP	04/26/90	6.93	1950	2.5	.010	< .010	440	.26	86.0	< .10
WNW86-06	UP	05/23/90	6.62	2070	2.3	< .006	< .005	478	.057	83.2	< .10
WNW86-06	UP	06/15/90	6.71	1872	2.2	< .007	.017	452	.18	65.8	< .10
WNW86-06	UP	08/15/90	6.33	1853	3.4	.120	.079	375	1.4	52.2	< .10
WNW86-06	UP	09/24/90	6.32	1725	4.6	.015	.030	357	.23	78.0	< .10
WNW86-06	UP	10/25/90	6.67	1406	2.5	< .010	.023	291	4.0	82.4	< .10
WNW86-06	UP	11/08/90	6.56	1307	2.4	< .008	.028	227	2.0	69.6	< .10
WNGSEEP	DOWN	02/21/90	6.49	490	8.5	< .008	< .010	43.0	.80	35.0	< .10
WNGSEEP	DOWN	04/24/90	6.58	549	< 1.0	< .007	.010	57.0	.59	68.0	< .10
WNGSEEP	DOWN	06/06/90	6.18	601	< 1.0	< .006	.057	71.0	.44	53.0	< .10
WNGSEEP	DOWN	06/14/90	6.42	625	< 1.0	< .008	.026	76.4	.87	49.6	< .10
WNGSEEP	DOWN	07/09/90	6.30	706	< 1.0	< .008	.029	95.6	.40	63.2	< .10
WNGSEEP	DOWN	09/24/90	6.35	707	< 1.0	.007	.011	92.1	.74	64.3	< .10
WNGSEEP	DOWN	10/24/90	6.31	659	1.0	< .008	.026	54.0	.80	86.0	< 1.00
WNGSEEP	DOWN	11/08/90	6.22	559	< 1.0	< .008	.022	59.1	.63	40.0	< .10
WNSP008	DOWN	02/21/90	6.90	956	26	< .008	.020	80.0	.59	84.0	< .10
WNSP008	DOWN	04/24/90	7.07	1003	1.8	< .007	.040	96.0	.69	110	< .10
WNSP008	DOWN	06/06/90	6.77	1004	2.2	< .006	.017	107	.51	73.0	.11
WNSP008	DOWN	06/14/90	6.98	1001	2.2	< .008	.014	112	.78	54.8	< .10
WNSP008	DOWN	09/10/90	6.89	N/A	N/A	.010	.016	91.8	.38	45.0	.12
WNSP008	DOWN	09/24/90	6.80	900	2.9	< .008	< .005	82.8	.71	61.1	< .10
WNSP008	DOWN	10/24/90	6.82	875	2.2	< .008	.013	74.0	.38	32.4	< .10
WNSP008	DOWN	11/08/90	6.72	858	1.8	< .008	.011	76.7	.25	55.7	< .10
WNW80-05	DOWN	02/21/90	6.77	851	3.0	< .008	< .010	110	.57	57.0	< .10
WNW80-05	DOWN	04/24/90	7.38	720	2.1	< .008	.010	92.0	.68	86.0	< .10
WNW80-05	DOWN	06/05/90	6.91	771	< 1.0	< .008	.0094	94.8	.29	42.4	.19
WNW80-05	DOWN	06/15/90	6.95	785	4.3	< .007	< .005	96.3	.089	50.0	.12
WNW80-05	DOWN	09/10/90	6.94	895	N/A	.006	.006	148	.15	63.2	.12
WNW80-05	DOWN	09/26/90	6.89	760	1.9	< .008	< .005	72.5	.44	31.2	.15
WNW80-05	DOWN	10/24/90	6.98	710	1.4	< .008	.100	91.5	.41	48.2	.15
WNW80-05	DOWN	11/12/90	6.88	744	< 1.0	< .007	.011	102	.37	56.3	.10

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

² Measured in $\mu\text{mhos/cm}$ at 25°C

N/A - Not available

TABLE E - 7 (continued)

1990 Water Quality Parameters for the Low-level Liquid Waste Treatment Facility (mg/L)

Location Code	Hydraulic Position	Sample Date	pH	Conductivity ²	TOC	Phenols	TOH	Chloride	Nitrate-N	Sulfate	Fluoride
*** Quality Standards ¹ ***			6.5-8.5	N/A	N/A	.001	N/A	250	10	250	1.5
WNW80-06	DOWN	02/20/90	6.69	747	4.3	< .008	< .010	36.0	.23	140.0	.13
WNW80-06	DOWN	04/23/90	6.60	405	3.5	< .008	< .010	66.0	.26	130.0	< .10
WNW80-06	DOWN	06/05/90	6.14	734	1.2	< .008	.030	68.5	< .05	77.4	.10
WNW80-06	DOWN	06/14/90	6.96	706	1.7	< .007	.005	86.4	.18	74.8	< .10
WNW80-06	DOWN	09/10/90	6.40	994	N/A	.020	.025	3.5	2.4	149.0	.12
WNW80-06	DOWN	09/27/90	6.33	936	4.2	< .008	.017	43.2	.57	180.0	.10
WNW80-06	DOWN	10/24/90	6.58	883	< 3.1	< .009	.009	56.0	.81	138.0	.11
WNW80-06	DOWN	11/07/90	6.20	789	1.0	.012	.006	77.0	.078	112.0	< .10
WNW86-03	DOWN	02/21/90	7.49	933	3.0	< .008	< .010	140	1.1	27.0	< .10
WNW86-03	DOWN	04/23/90	7.52	912	2.3	< .008	.030	160	.095	39.0	< .10
WNW86-03	DOWN	05/24/90	7.24	910	2.5	< .007	< .005	131	< .050	40.8	< .10
WNW86-03	DOWN	06/15/90	7.22	915	2.7	< .007	.007	121	.91	42.8	< .10
WNW86-03	DOWN	07/09/90	7.23	935	< 1.0	< .008	.012	154	1.3	37.8	< .10
WNW86-03	DOWN	09/24/90	7.13	959	2.4	< .008	.006	166	.40	46.7	< .10
WNW86-03	DOWN	10/24/90	7.32	978	< 1.0	< .008	.010	154	1.8	27.4	< .10
WNW86-03	DOWN	11/08/90	7.31	973	< 1.0	< .008	< .005	156	3.3	33.6	< .10
WNW86-04	DOWN	03/01/90	7.16	922	5.2	< .008	< .010	140	1.7	30.0	< .10
WNW86-04	DOWN	04/26/90	7.44	926	< 1.0	< .008	< .010	130	1.40	49.0	< .10
WNW86-04	DOWN	05/23/90	7.14	928	< 1.0	< .006	< .005	120	.11	48.0	< .10
WNW86-04	DOWN	06/15/90	7.18	912	< 1.0	< .008	.006	128	1.1	40.4	< .10
WNW86-04	DOWN	09/12/90	7.22	932	< 1.0	.044	.005	155	.92	87.0	< .10
WNW86-04	DOWN	09/24/90	7.13	931	< 1.0	< .009	< .005	143	.29	N/A	N/A
WNW86-04	DOWN	10/24/90	7.34	951	< 1.0	< .008	.008	154	.88	38.4	< .10
WNW86-04	DOWN	11/08/90	7.39	948	< 1.0	< .008	< .005	142	.97	57.8	< .10
WNW86-05	DOWN	03/01/90	6.84	814	7.81	.027	.027	21.8	< .10	62.1	.10
WNW86-05	DOWN	04/26/90	7.08	600	11.0	< .010	N/A	6.8	< .10	46.7	.11
WNW86-05	DOWN	06/08/90	6.77	848	12.3	< .010	N/A	19.5	< .10	70.8	.11
WNW86-05	DOWN	06/21/90	6.57	911	13.9	< .010	< .010	17.2	< .10	63.4	.12
WNW86-05	DOWN	09/12/90	6.59	832	15.9	< .010	< .010	15.63	< .10	48.0	.12
WNW86-05	DOWN	09/27/90	6.51	916	11.96	.039	.071	32.5	< .10	73.2	.14
WNW86-05	DOWN	10/24/90	6.65	727	11.9	.012	.012	16.0	< .10	51.6	.12
WNW86-05	DOWN	11/12/90	6.55	738	13.3	< .010	.011	14.7	< .10	50.7	.16

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

² Measured in μ mhos/cm at 25°C

N/A - Not available

TABLE E - 8

1990 Total Metals for the Low-level Liquid Waste Treatment Facility (mg/L)

Location Code	Hydraulic Position	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Silver	Sodium
Quality Standards¹			.025	1.0	.01	.05	.30	.025	.30	.002	.01	.05	< 20
WNW86-06	UP	03/08/90	< .005	.06	< .005	< .010	2.3	< .005	4.3	< .0004	< .005	< .005	240
WNW86-06	UP	04/26/90	.040	.09	.005	< .010	5.8	.009	2.8	< .0004	< .005	< .005	330
WNW86-06	UP	05/23/90	< .005	.13	< .005	< .010	1.6	< .005	2.6	N/A	< .005	.010	245
WNW86-06	UP	06/15/90	< .005	.09	.007	< .010	1.4	< .005	2.0	.0005	< .005	.011	230
WNW86-06	UP	08/15/90	< .005	.081	< .005	< .010	.15	< .005	2.2	.0070	< .005	< .010	295
WNW86-06	UP	09/24/90	< .005	.089	< .005	< .010	.19	< .003	1.8	.0005	< .005	< .005	248
WNW86-06	UP	10/25/90	< .005	.16	.009	< .010	1.2	< .003	.97	< .0004	< .005	< .006	190
WNW86-06	UP	11/08/90	< .005	< .15	.010	< .010	.62	< .003	3.1	< .0004	< .005	< .005	180
WNGSEEP	DOWN	02/21/90	< .005	.07	< .005	< .010	< .05	< .005	< .010	< .0004	< .005	< .005	9.4
WNGSEEP	DOWN	04/24/90	< .005	.12	.006	< .010	< .05	< .005	.010	< .0004	< .005	< .010	9.9
WNGSEEP	DOWN	06/06/90	< .005	.12	.005	< .010	< .05	< .005	< .005	< .0004	< .005	< .010	11.7
WNGSEEP	DOWN	06/14/90	< .005	.13	.008	< .010	< .05	< .005	< .005	< .0004	< .005	< .010	12.9
WNGSEEP	DOWN	07/09/90	< .005	.13	< .005	< .010	< .05	< .005	< .005	< .0004	< .005	< .007	16.7
WNGSEEP	DOWN	09/24/90	< .005	.14	< .005	< .010	.036	< .003	.005	< .0004	< .005	< .005	19.5
WNGSEEP	DOWN	10/24/90	< .005	.12	< .005	< .010	< .05	< .003	< .007	< .0004	< .005	< .006	31.0
WNGSEEP	DOWN	11/08/90	< .005	< .15	.005	< .010	.48	.013	< .007	< .0004	< .005	< .005	14.1
WNSP008	DOWN	02/21/90	< .005	.09	< .005	< .010	< .05	< .005	1.6	< .0004	.006	.012	44.0
WNSP008	DOWN	04/24/90	< .005	.09	.011	< .010	.05	< .005	1.7	< .0004	< .005	< .010	41.0
WNSP008	DOWN	06/06/90	.005	.09	.007	< .010	.07	< .005	1.7	< .0004	< .005	< .010	53.4
WNSP008	DOWN	06/14/90	< .005	.08	.005	< .010	69.0	< .005	2.6	.0007	< .005	< .010	51.7
WNSP008	DOWN	09/10/90	< .005	.11	< .005	< .010	< .05	< .003	1.5	< .0004	< .005	< .005	60.0
WNSP008	DOWN	09/24/90	< .005	.076	< .005	< .010	.077	< .003	1.4	< .0004	< .005	< .005	58.2
WNSP008	DOWN	10/24/90	< .005	.10	.007	< .010	.06	< .003	2.0	.0039	< .005	.053	51.0
WNSP008	DOWN	11/08/90	< .005	< .15	.008	< .010	.06	< .003	2.5	< .0004	< .005	< .005	50.6
WNW80-05	DOWN	02/21/90	< .005	.13	< .005	< .010	3.1	< .005	.049	< .0004	< .005	< .005	21.0
WNW80-05	DOWN	04/24/90	< .005	.11	.010	< .010	14.0	.011	.068	< .0004	< .005	< .010	22.0
WNW80-05	DOWN	06/05/90	< .005	.12	< .005	.026	26.3	.009	.087	< .0004	< .005	< .010	26.5
WNW80-05	DOWN	06/15/90	< .005	.09	.006	< .010	14.8	< .005	.10	< .0004	< .005	< .010	22.4
WNW80-05	DOWN	09/10/90	< .005	.22	< .005	< .010	7.4	.003	.09	< .0004	< .005	< .005	38.0
WNW80-05	DOWN	09/26/90	< .005	.10	.013	< .010	33.4	.019	.074	< .0004	< .005	< .005	26.9
WNW80-05	DOWN	10/24/90	< .005	.10	.008	< .010	17.3	.005	.045	.0012	< .005	< .006	57.6
WNW80-05	DOWN	11/12/90	< .005	.18	.009	.012	64.0	.016	.12	< .0004	< .005	< .006	28.7

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

TABLE E - 8 (continued)

1990 Total Metals for the Low-level Liquid Waste Treatment Facility (mg/L)

Location Code	Hydraulic Position	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Silver	Sodium
Quality Standards¹			.025	1.0	.01	.05	.30	.025	.30	.002	.01	.05	<20
WNW80-06	DOWN	02/20/90	< .005	< .06	< .005	< .010	.44	.006	1.6	< .0004	< .005	.016	7.9
WNW80-06	DOWN	04/23/90	< .005	.08	.007	< .010	.30	< .005	3.1	< .0004	< .005	.005	10.0
WNW80-06	DOWN	06/05/90	< .005	.05	< .005	< .010	1.3	.027	5.2	< .0004	< .005	< .010	11.2
WNW80-06	DOWN	06/14/90	< .005	.07	.007	< .010	.26	< .005	7.8	< .0004	< .005	< .010	9.4
WNW80-06	DOWN	09/10/90	< .005	.21	< .005	< .010	< .05	.003	3.2	< .0004	< .005	< .005	12.0
WNW80-06	DOWN	09/27/90	< .005	.01	< .005	< .010	.61	.013	1.9	< .0004	< .005	< .005	12.6
WNW80-06	DOWN	10/24/90	< .005	.09	.011	< .010	1.4	.009	4.2	.0014	< .005	< .006	27.7
WNW80-06	DOWN	11/07/90	< .005	.12	< .005	< .010	3.9	.017	7.9	< .0004	< .005	< .005	16.2
WNW86-03	DOWN	02/21/90	< .005	.19	< .005	< .010	1.2	< .005	.035	< .0004	< .005	.006	23.0
WNW86-03	DOWN	04/23/90	< .005	.22	.006	< .010	.83	< .005	.053	< .0004	< .005	.007	26.0
WNW86-03	DOWN	05/24/90	< .005	.25	< .005	< .010	.95	< .005	.030	< .0004	< .005	< .010	22.6
WNW86-03	DOWN	06/15/90	.007	.29	.011	.013	19.8	.014	< .005	< .0004	.014	< .010	22.6
WNW86-03	DOWN	07/09/90	< .005	.22	.010	.013	4.2	< .005	.14	< .0004	< .005	< .007	26.8
WNW86-03	DOWN	09/24/90	< .005	.26	.006	.013	3.0	.004	.13	< .0004	< .005	< .005	31.4
WNW86-03	DOWN	10/24/90	< .005	.26	.007	< .010	1.8	.003	.05	.0034	< .005	< .006	65.2
WNW86-03	DOWN	11/08/90	< .005	.27	.008	< .010	1.5	.004	.051	< .0004	< .005	< .005	29.9
WNW86-04	DOWN	03/01/90	< .005	.30	< .005	< .010	5.0	.005	.36	< .0004	< .005	.008	33.0
WNW86-04	DOWN	04/26/90	.007	.26	.011	< .010	17.0	.010	.25	< .0004	< .005	.007	28.0
WNW86-04	DOWN	05/23/90	< .005	.25	.010	< .010	6.8	< .005	.13	< .0004	< .005	< .005	25.1
WNW86-04	DOWN	06/15/90	.006	.31	.008	< .010	10.1	.008	.20	< .0004	< .005	.011	21.6
WNW86-04	DOWN	09/12/90	.010	.41	.018	.027	24.4	.028	.41	< .0004	< .005	< .005	29.2
WNW86-04	DOWN	09/24/90	< .005	.60	.008	.014	6.9	.005	.16	< .0004	< .005	< .005	26.7
WNW86-04	DOWN	10/24/90	< .005	.34	< .005	< .010	12.1	.008	.18	< .0008	< .005	< .006	63.2
WNW86-04	DOWN	11/08/90	.006	.41	.010	< .010	17.3	< .010	.28	< .0004	< .005	< .005	27.6
WNW86-05	DOWN	03/01/90	.006	.084	< .002	.018	2.82	.009	5.650	< .0002	< .002	< .010	27.8
WNW86-05	DOWN	04/26/90	.005	.088	.003	.031	3.77	< .002	10.80	< .0002	< .002	.013	34.1
WNW86-05	DOWN	06/08/90	< .050	.114	.003	.021	5.25	.002	10.90	.0002	.002	.014	63.4
WNW86-05	DOWN	06/21/90	.007	.106	.003	.022	3.92	< .002	9.870	N/A	< .002	.013	70.6
WNW86-05	DOWN	09/12/90	.008	.10	.003	.014	2.65	< .002	9.189	< .0002	< .004	.010	64.8
WNW86-05	DOWN	09/27/90	.009	.119	.003	< .020	5.08	< .002	10.60	< .0002	< .002	< .010	67.2
WNW86-05	DOWN	10/24/90	.008	.103	.003	.013	4.56	< .002	9.290	< .0002	< .002	.015	46.0
WNW86-05	DOWN	11/12/90	.009	.101	.004	.013	4.508	< .002	9.489	< .0002	< .002	.015	46.71

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

TABLE E - 9

1990 Dissolved Metals for the Low-level Liquid Waste Treatment Facility (mg/L)

Location Code	Hydraulic Position	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Silver	Sodium
** Quality Standards¹**			.025	1.0	.01	.05	.30	.025	.30	.002	.01	.05	<20
WNW86-06	UP	03/08/90	<.005	<.05	<.005	<.010	<.05	<.005	.61	<.0004	<.005	<.005	230
WNW86-06	UP	04/26/90	<.005	<.06	<.005	<.010	<.05	<.005	.67	<.0004	<.005	<.005	250
WNW86-06	UP	05/23/90	<.005	.06	<.005	<.010	<.05	<.005	.86	<.0004	<.005	<.005	275
WNW86-06	UP	06/15/90	<.005	.07	<.005	<.010	<.05	<.005	1.0	<.0004	<.005	<.010	301
WNW86-06	UP	08/15/90	<.005	.068	<.005	<.010	<.04	.005	.91	<.0004	<.005	<.010	294
WNW86-06	UP	09/24/90	<.005	.081	<.005	<.010	.049	<.003	1.2	<.0004	<.005	<.005	250
WNW86-06	UP	10/25/90	<.005	<.15	<.005	<.010	.06	<.003	.95	<.0004	<.005	<.006	224
WNW86-06	UP	11/08/90	<.005	<.15	<.005	<.010	.08	<.003	.62	<.0004	<.005	<.005	205
WNGSEEP	DOWN	02/21/90	<.005	<.06	<.005	<.010	<.05	<.005	<.01	<.0004	<.005	<.005	11.0
WNGSEEP	DOWN	04/24/90	<.005	.12	<.005	<.010	<.05	<.005	<.01	<.0004	<.005	<.010	11.0
WNGSEEP	DOWN	06/06/90	<.005	.12	.007	<.010	<.05	<.005	<.005	<.0004	<.005	<.010	14.4
WNGSEEP	DOWN	06/14/90	<.005	.12	<.005	<.010	<.05	<.005	<.005	<.0004	<.005	<.010	12.4
WNGSEEP	DOWN	07/09/90	<.005	.11	<.005	<.010	<.05	<.005	<.005	<.0004	<.005	<.007	15.5
WNGSEEP	DOWN	09/24/90	<.005	.15	<.005	<.010	<.02	<.003	<.005	<.0004	<.005	<.005	19.0
WNGSEEP	DOWN	10/24/90	<.005	.14	<.005	<.010	<.05	<.003	<.007	<.0004	<.005	<.005	15.2
WNGSEEP	DOWN	11/08/90	<.005	<.15	<.005	<.010	<.05	<.003	<.007	<.0004	<.005	<.005	15.1
WNSP008	DOWN	02/21/90	<.005	.09	<.005	<.010	<.05	<.005	1.7	<.0004	<.005	.008	48.0
WNSP008	DOWN	04/24/90	<.005	.09	.006	<.010	<.05	<.005	1.7	<.0004	<.005	<.010	47.0
WNSP008	DOWN	06/06/90	<.005	.08	.005	<.010	<.05	<.005	1.8	<.0004	<.005	<.010	61.8
WNSP008	DOWN	06/14/90	<.005	.08	<.005	<.010	.15	<.005	1.7	<.0004	<.005	<.010	61.8
WNSP008	DOWN	09/10/90	<.005	<.07	<.005	<.010	<.05	<.003	1.4	<.0004	<.005	<.005	56.0
WNSP008	DOWN	09/24/90	<.005	.076	<.005	<.010	<.02	<.003	1.4	<.0004	<.005	<.005	56.9
WNSP008	DOWN	10/24/90	<.005	.08	<.005	<.010	<.05	<.003	<.007	.0021	<.005	<.005	51.7
WNSP008	DOWN	11/08/90	<.005	<.15	<.005	<.010	<.05	<.003	1.5	<.0004	<.005	<.005	54.3
WNW80-05	DOWN	02/21/90	<.005	.13	<.005	<.010	.12	<.005	.025	<.0004	<.005	<.005	24.0
WNW80-05	DOWN	04/24/90	<.005	.11	<.005	<.010	.29	<.005	.013	<.0004	<.005	<.010	26.0
WNW80-05	DOWN	06/05/90	<.005	.10	<.005	.013	1.6	<.005	.068	<.0004	<.005	<.010	31.3
WNW80-05	DOWN	06/15/90	<.005	.12	<.005	<.010	.73	<.005	.095	<.0004	<.005	<.010	32.1
WNW80-05	DOWN	09/10/90	<.005	.08	<.005	<.010	5.4	<.003	.008	<.0004	<.005	<.005	36.0
WNW80-05	DOWN	09/26/90	<.005	.16	<.005	<.010	5.3	<.003	.076	<.0004	<.005	<.005	16.1
WNW80-05	DOWN	10/24/90	<.005	.12	<.005	<.010	.48	<.003	.019	<.0004	<.005	<.005	28.0
WNW80-05	DOWN	11/12/90	<.005	<.15	<.005	<.010	.46	<.003	<.007	<.0004	<.005	<.006	28.0

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

N/A - Not available

TABLE E - 9 (continued)

1990 Dissolved Metals for the Low-level Liquid Waste Treatment Facility (mg/L)

Location Code	Hydraulic Position	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Silver	Sodium
Quality Standards¹			.025	1.0	.01	.05	.30	.025	.30	.002	.01	.05	< 20
WNW80-06	DOWN	02/20/90	<.005	<.06	<.005	<.010	.08	<.005	1.6	<.0004	<.005	<.005	8.90
WNW80-06	DOWN	04/23/90	<.005	.08	<.005	<.010	.11	<.005	2.6	<.0004	<.005	<.010	13.00
WNW80-06	DOWN	06/05/90	<.005	.07	<.005	<.010	.23	<.005	5.1	<.0004	<.005	<.010	12.50
WNW80-06	DOWN	06/14/90	<.005	.08	<.005	<.010	.29	<.005	7.0	<.0004	<.005	<.010	11.50
WNW80-06	DOWN	09/10/90	<.005	.10	<.005	<.010	<.05	<.003	3.7	<.0004	<.005	<.005	11.00
WNW80-06	DOWN	09/27/90	<.005	.12	<.005	<.010	.12	.012	4.2	<.0004	<.005	<.005	12.10
WNW80-06	DOWN	10/24/90	<.005	.10	<.005	<.010	<.05	<.003	3.5	.0012	<.005	<.005	13.00
WNW80-06	DOWN	11/07/90	<.005	.11	<.005	<.010	.054	<.003	5.4	<.0004	<.005	<.005	15.60
WNW86-03	DOWN	02/21/90	<.005	.25	<.005	<.010	<.05	<.005	.026	<.0004	<.005	<.005	27.00
WNW86-03	DOWN	04/23/90	<.005	.21	<.005	<.010	<.05	<.005	.007	<.0004	<.005	<.010	29.00
WNW86-03	DOWN	05/24/90	<.005	.23	<.005	<.010	<.05	<.005	.007	<.0004	<.005	<.010	26.80
WNW86-03	DOWN	06/15/90	.005	.23	<.005	<.010	<.05	<.005	<.005	<.0004	<.005	<.010	28.80
WNW86-03	DOWN	07/09/90	<.005	.19	.009	.013	<.05	<.005	.008	<.0004	<.005	<.007	27.80
WNW86-03	DOWN	09/24/90	<.005	.23	<.005	<.010	<.02	<.003	.005	<.0004	<.005	<.005	31.20
WNW86-03	DOWN	10/24/90	<.005	.24	<.005	<.010	<.05	<.003	.007	.0015	<.005	<.005	32.00
WNW86-03	DOWN	11/08/90	<.005	<.15	<.005	<.010	<.05	<.003	.009	<.0004	<.005	<.005	31.8
WNW86-04	DOWN	03/01/90	<.005	.21	<.005	<.010	.04	<.005	.03	<.0004	<.005	<.005	29.0
WNW86-04	DOWN	04/26/90	<.005	.17	<.005	<.010	<.05	<.005	.034	<.0004	<.005	.005	30.0
WNW86-04	DOWN	05/23/90	<.005	.22	<.005	<.010	<.05	<.005	.025	<.0004	<.005	<.005	28.2
WNW86-04	DOWN	06/15/90	<.005	.27	<.005	<.010	.11	<.005	.054	<.0004	<.005	<.010	27.1
WNW86-04	DOWN	09/12/90	<.005	.29	<.005	<.010	.10	<.003	.06	<.0004	<.005	<.005	30.4
WNW86-04	DOWN	09/24/90	<.005	.33	<.005	<.010	.16	<.003	.058	<.0004	<.005	<.005	28.0
WNW86-04	DOWN	10/24/90	<.005	.32	<.005	<.010	.17	<.003	.057	.0006	<.005	<.005	30.0
WNW86-04	DOWN	11/08/90	<.005	.26	.006	<.010	.12	<.003	.05	<.0004	<.005	<.005	29.2
WNW86-05	DOWN	03/01/90	.002	.078	<.002	.017	.838	.007	5.790	<.0002	<.002	<.010	28.2
WNW86-05	DOWN	04/26/90	.005	.09	.002	.018	2.88	.003	11.20	<.0002	<.002	.011	36.9
WNW86-05	DOWN	06/08/90	<.050	.112	.003	.022	4.64	.002	10.70	.0002	.002	.015	63.8
WNW86-05	DOWN	06/21/90	.008	.12	.003	.023	5.87	.004	11.10	N/A	<.002	.015	73.4
WNW86-05	DOWN	09/12/90	.008	.10	.002	<.010	2.77	<.002	9.243	<.0002	<.002	<.010	65.3
WNW86-05	DOWN	09/27/90	.010	.115	.004	<.020	4.40	<.002	10.60	<.0002	<.002	<.010	67.4
WNW86-05	DOWN	10/24/90	.010	.104	.004	.014	4.38	<.002	9.450	<.0002	<.002	.015	46.1
WNW86-05	DOWN	11/12/90	.008	.098	.003	.012	4.21	<.002	9.258	<.0002	<.002	.014	45.96

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

N/A - Not available

TABLE E - 10

1990 Radioactivity Concentrations in the Low-level Liquid Waste Treatment Facility ($\mu\text{Ci/mL}$)

Location Code	Hydraulic Position	Sample Date	Gross Alpha	Gross Beta	Tritium	Cs-137	Co-60
****Department of Energy DCGs ****			3.0E-08	1.0E-06	2.0E-03	3.0E-06	5.0E-06
****Quality Standards ¹ ****			1.5E-08	1.0E-06	2.0E-05	N/A	N/A
WNW86-06	UP	03/08/90	< 2.41E-09	< 4.36E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-06	UP	04/26/90	< 2.68E-09	< 6.70E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-06	UP	05/23/90	< 8.24E-09	< 5.73E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-06	UP	06/15/90	< 5.93E-09	7.28±6.19E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-06	UP	08/15/90	< 3.89E-09	< 5.59E-09	< 9.84E-08	< 3.7E-08	< 3.8E-08
WNW86-06	UP	09/24/90	< 6.68E-09	6.85±6.58E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-06	UP	10/25/90	4.54±4.45E-09	< 5.91E-09	< 1.17E-07	< 3.7E-08	< 3.8E-08
WNW86-06	UP	11/08/90	< 5.40E-09	< 5.54E-09	< 1.18E-07	< 3.7E-08	< 3.8E-08
WNGSEEP	DOWN	02/21/90	< 2.36E-09	2.75±2.05E-09	9.36±1.32E-07	< 3.7E-08	< 3.8E-08
WNGSEEP	DOWN	04/24/90	< 2.67E-09	3.17±1.56E-09	8.86±1.30E-07	< 3.7E-08	< 3.8E-08
WNGSEEP	DOWN	06/06/90	< 3.87E-09	4.51±2.16E-09	8.82±1.31E-07	< 3.7E-08	< 3.8E-08
WNGSEEP	DOWN	06/14/90	< 5.23E-09	4.58±2.06E-09	1.02±0.13E-06	< 3.7E-08	< 3.8E-08
WNGSEEP	DOWN	07/09/90	< 1.26E-09	3.19±1.93E-09	2.58±0.74E-07	< 3.7E-08	< 3.8E-08
WNGSEEP	DOWN	09/24/90	< 3.20E-09	6.53±1.61E-09	8.17±1.38E-07	< 3.7E-08	< 3.8E-08
WNGSEEP	DOWN	10/24/90	3.31±2.65E-09	4.22±2.13E-09	6.72±1.23E-07	< 3.7E-08	< 3.8E-08
WNGSEEP	DOWN	11/08/90	< 4.38E-09	3.07±1.82E-09	8.34±1.30E-07	< 3.7E-08	< 3.8E-08
WNSP008	DOWN	02/21/90	< 2.73E-09	4.58±.52E-08	7.01±.29E-06	< 3.7E-08	< 3.8E-08
WNSP008	DOWN	04/24/90	< 5.20E-09	3.20±.46E-08	5.88±.26E-06	< 3.7E-08	< 3.8E-08
WNSP008	DOWN	06/06/90	< 5.33E-09	5.17±.60E-08	5.92±.26E-06	< 3.7E-08	< 3.8E-08
WNSP008	DOWN	06/14/90	< 8.74E-09	6.01±.61E-08	6.05±.27E-06	< 3.7E-08	< 3.8E-08
WNSP008	DOWN	09/10/90	< 5.18E-09	4.75±.55E-08	3.50±.19E-06	< 3.7E-08	< 3.8E-08
WNSP008	DOWN	09/24/90	< 4.54E-09	4.91±.56E-08	7.36±1.26E-07	< 3.7E-08	< 3.8E-08
WNSP008	DOWN	10/24/90	< 7.55E-09	5.30±.58E-08	5.49±.25E-06	< 3.7E-08	< 3.8E-08
WNSP008	DOWN	11/08/90	< 6.11E-09	4.21±.53E-08	5.45±.25E-06	< 3.7E-08	< 3.8E-08
WNW80-05	DOWN	02/21/90	< 5.94E-09	4.63±1.91E-09	9.55±3.30E-07	< 3.7E-08	< 3.8E-08
WNW80-05	DOWN	04/24/90	< 5.04E-09	3.78±1.78E-09	6.54±1.26E-07	< 3.7E-08	< 3.8E-08
WNW80-05	DOWN	06/05/90	< 4.34E-09	3.88±2.09E-09	9.11±1.35E-07	< 3.7E-08	< 3.8E-08
WNW80-05	DOWN	06/15/90	< 5.06E-09	< 2.06E-09	1.21±.14E-06	< 3.7E-08	< 3.8E-08
WNW80-05	DOWN	09/10/90	< 3.06E-09	2.37±2.09E-09	7.90±1.34E-07	< 3.7E-08	< 3.8E-08
WNW80-05	DOWN	09/26/90	< 6.84E-09	8.87±1.93E-09	4.79±.23E-06	< 3.7E-08	< 3.8E-08
WNW80-05	DOWN	10/24/90	< 4.18E-09	< 1.85E-09	6.55±1.24E-07	< 3.7E-08	< 3.8E-08
WNW80-05	DOWN	11/12/90	< 5.33E-09	3.45±2.05E-09	7.08±1.28E-07	< 3.7E-08	< 3.8E-08

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

N/A Not available

Note: Gross alpha DCG as Am-241; gross beta DCG as Sr-90

TABLE E - 10 (continued)

1990 Radioactivity Concentrations in the Low-level Liquid Waste Treatment Facility ($\mu\text{Ci/mL}$)

Location Code	Hydraulic Position	Sample Date	Gross Alpha	Gross Beta	Tritium	Cs-137	Co-60
*****Department of Energy DCGs*****			3.0E-08	1.0E-06	2.0E-03	3.0E-06	5.0E-06
*****Quality Standards ¹ *****			1.5E-08	1.0E-06	2.0E-05	N/A	N/A
WNW80-06	DOWN	02/20/90	<4.54E-09	3.04±2.27E-09	6.42±1.26E-07	<3.7E-08	<3.8E-08
WNW80-06	DOWN	04/23/90	<6.02E-09	2.84±1.68E-09	1.20±.14E-06	<3.7E-08	<3.8E-08
WNW80-06	DOWN	06/05/90	<3.06E-09	2.96±1.95E-09	1.15±.14E-06	<3.7E-08	<3.8E-08
WNW80-06	DOWN	06/14/90	<2.48E-09	4.00±2.18E-09	1.50±.14E-06	<3.7E-08	<3.8E-08
WNW80-06	DOWN	09/10/90	<6.71E-09	4.81±2.26E-09	1.01±0.13E-06	<3.7E-08	<3.8E-08
WNW80-06	DOWN	09/27/90	<6.01E-09	1.21±.21E-08	5.94±1.23E-07	<3.7E-08	<3.8E-08
WNW80-06	DOWN	10/24/90	<9.67E-09	7.27±2.54E-09	4.87±0.78E-07	<3.7E-08	<3.8E-08
WNW80-06	DOWN	11/07/90	<5.25E-09	4.83±2.14E-09	1.42±0.14E-06	<3.7E-08	<3.8E-08
WNW86-03	DOWN	02/21/90	<4.70E-09	1.31±.32E-08	1.18±.14E-06	<3.7E-08	<3.8E-08
WNW86-03	DOWN	04/23/90	<7.43E-09	1.22±.31E-08	8.79±1.30E-07	<3.7E-08	<3.8E-08
WNW86-03	DOWN	05/24/90	<5.06E-08	3.41±1.95E-08	9.64±1.33E-07	<3.7E-08	<3.8E-08
WNW86-03	DOWN	06/15/90	<6.91E-09	1.34±.34E-08	1.42±0.14E-06	<3.7E-08	<3.8E-08
WNW86-03	DOWN	07/09/90	<6.35E-09	1.16±.35E-08	9.78±0.89E-07	<3.7E-08	<3.8E-08
WNW86-03	DOWN	09/24/90	<6.67E-09	1.98±.40E-08	1.14±0.13E-06	<3.7E-08	<3.8E-08
WNW86-03	DOWN	10/24/90	<8.10E-09	1.42±.37E-08	1.31±0.14E-06	<3.7E-08	<3.8E-08
WNW86-03	DOWN	11/08/90	<8.99E-09	1.47±.36E-08	1.06±0.13E-06	<3.7E-08	<3.8E-08
WNW86-04	DOWN	03/01/90	<2.11E-09	2.95±.12E-07	9.05±1.33E-07	<3.7E-08	<3.8E-08
WNW86-04	DOWN	04/26/90	<4.46E-09	4.75±.15E-07	1.08±.14E-06	<3.7E-08	<3.8E-08
WNW86-04	DOWN	05/23/90	<4.93E-09	6.37±.17E-07	1.14±.14E-06	<3.7E-08	<3.8E-08
WNW86-04	DOWN	06/15/90	<1.17E-08	4.27±.15E-07	1.32±.14E-06	<3.7E-08	<3.8E-08
WNW86-04	DOWN	09/12/90	<4.23E-09	5.25±.16E-07	1.25±.14E-06	<3.7E-08	<3.8E-08
WNW86-04	DOWN	09/24/90	<1.16E-08	4.68±.16E-07	1.13±.13E-06	<3.7E-08	<3.8E-08
WNW86-04	DOWN	10/24/90	<6.86E-09	5.20±.17E-07	1.95±.11E-06	<3.7E-08	<3.8E-08
WNW86-04	DOWN	11/08/90	<1.09E-08	5.74±.18E-07	1.45±.14E-06	<3.7E-08	<3.8E-08
WNW86-05	DOWN	03/01/90	5.29±4.99E-09	2.60±.02E-05	1.42±.59E-05	<3.7E-08	<3.8E-08
WNW86-05	DOWN	04/26/90	5.59±4.79E-09	1.76±.01E-05	1.59±.60E-05	<3.7E-08	<3.8E-08
WNW86-05	DOWN	06/08/90	8.59±7.88E-09	3.21±.02E-05	2.16±.07E-05	<3.7E-08	<3.8E-08
WNW86-05	DOWN	06/21/90	<7.33E-09	3.34±.02E-05	1.70±.06E-05	<3.7E-08	<3.8E-08
WNW86-05	DOWN	09/12/90	<1.08E-08	2.32±.03E-05	1.53±.05E-05	<3.7E-08	<3.8E-08
WNW86-05	DOWN	09/27/90	<1.03E-08	3.08±.03E-05	1.73±.06E-05	<3.7E-08	<3.8E-08
WNW86-05	DOWN	10/24/90	<8.48E-09	2.85±.03E-05	1.65±.06E-05	<3.7E-08	<3.8E-08
WNW86-05	DOWN	11/12/90	<1.02E-08	2.90±.03E-05	1.50±.05E-05	<3.7E-08	<3.8E-08

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

N/A Not available

Note: Gross alpha DCG as Am-241; gross beta DCG as Sr-90

TABLE E - 11

1990 Water Quality Parameters for the NRC-licensed Disposal Area Groundwater Monitoring Unit (mg/L)

Location Code	Hydraulic Position	Sample Date	pH	Conductivity ²	TOC	Phenols	TOH	Chloride	Nitrate-N	Sulfate	Fluoride
*** Quality Standards ¹ ***			6.5-8.5	N/A	N/A	.001	N/A	250	10	250	1.5
WNW83-1D	UP	06/07/90	7.75	287	< 1.0	<.008	<.005	6.0	.15	13.2	.42
WNW83-1D	UP	06/14/90	7.73	287	1.0	<.008	<.005	7.2	<.05	19.2	.27
WNW83-1D	UP	06/19/90	7.64	288	N/A	<.014	<.005	6.5	.20	34.0	.27
WNW83-1D	UP	07/03/90	7.70	257	8.1	.020	N/A	5.2	.10	4.0	.39
WNW83-1D	UP	09/24/90	7.93	291	< 1.0	<.008	.340	8.8	.24	6.0	.40
WNW83-1D	UP	10/23/90	7.86	283	< 1.0	<.008	<.005	8.2	.056	40.0	.40
WNW83-1D	UP	11/08/90	7.58	299	1.3	<.008	<.005	6.2	<.05	17.7	.38
WNW86-10	DOWN	02/01/90	8.19	628	2.0	<.008	<.010	1.7	.051	100	.13
WNW86-10	DOWN	06/21/90	7.82	694	3.6	<.012	<.005	2.1	<.05	105	.11
WNW86-10	DOWN	06/26/90	8.01	757	12.4	<.007	<.005	1.8	<.05	119	.12
WNW86-10	DOWN	06/28/90	8.13	702	13.6	<.008	.007	1.8	.05	109	.11
WNW86-10	DOWN	11/12/90	8.20	705	1.2	<.009	.013	<1.0	<.05	93.0	<.10
WNW86-10	DOWN	11/28/90	8.12	673	5.8	<.008	<.005	4.3	.086	94.0	.16
WNW86-10	DOWN	12/06/90	7.90	699	15.2	<.010	<.010	4.3	N/A	75.6	.16
WNW86-10	DOWN	12/13/90	7.39	722	12.4	.006	.013	5.1	.16	320	.14
WNW86-11	DOWN	02/01/90	7.98	763	3.0	<.007	<.010	<1.0	.12	160	.18
WNW86-11	DOWN	06/07/90	7.56	751	6.5	<.006	.017	2.5	.14	200	.16
WNW86-11	DOWN	06/21/90	7.82	N/A	5.9	<.007	.024	2.7	.19	206	.18
WNW86-11	DOWN	06/26/90	7.80	N/A	3.3	<.007	<.005	1.6	<.05	239	.12
WNW86-11	DOWN	09/13/90	7.56	853	2.4	.059	.010	<1.0	.081	234	.17
WNW86-11	DOWN	09/27/90	7.62	860	3.2	<.008	.008	7.2	.11	46.4	.17
WNW86-11	DOWN	10/25/90	7.52	850	2.6	<.010	.013	5.0	.17	175	.14
WNW86-11	DOWN	11/08/90	7.44	849	< 1.0	<.005	<.005	<1.0	<.050	182	.16

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

² Measured in $\mu\text{mhos/cm}$ at 25°C

N/A Not available

TABLE E - 12

1990 Total Metals for the NRC-licensed Disposal Area Groundwater Monitoring Unit (mg/L)

Location Code	Hydraulic Position	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Silver	Sodium
Quality Standards¹			.025	1.0	.01	.05	.30	.025	.30	.002	.01	.05	< 20
WNW83-1D	UP	06/07/90	.005	.85	.010	.036	23.3	.010	.31	< .0004	< .005	< .010	15.8
WNW83-1D	UP	06/14/90	.020	.84	.009	.018	3.1	.011	.14	< .0004	< .005	< .010	18.4
WNW83-1D	UP	06/19/90	< .005	.87	.007	.023	10.4	.009	.18	< .0004	< .005	< .010	15.8
WNW83-1D	UP	07/03/90	.007	.82	< .010	< .010	16.7	< .005	.26	< .0004	.011	< .007	19.1
WNW83-1D	UP	09/24/90	< .005	.84	< .005	< .010	2.7	< .003	.13	< .0004	< .005	< .005	19.0
WNW83-1D	UP	10/23/90	< .005	.079	.008	< .010	1.93	< .003	.14	.0015	< .005	.023	39.7
WNW83-1D	UP	11/08/90	< .005	.71	.007	< .010	3.6	< .003	.14	< .0004	< .005	< .005	18.0
WNW86-10	DOWN	02/01/90	< .005	.12	.005	.076	7.4	.016	.18	< .0004	< .005	< .010	69.0
WNW86-10	DOWN	06/21/90	.008	.11	.009	.140	16.5	.029	.30	.0011	< .005	< .010	62.5
WNW86-10	DOWN	06/26/90	.006	.17	< .005	.073	11.2	.042	.25	< .0004	< .005	.015	66.4
WNW86-10	DOWN	06/28/90	< .005	.11	< .005	.054	14.7	.031	.38	< .0004	< .005	< .010	68.4
WNW86-10	DOWN	11/12/90	.006	.10	< .005	.018	5.6	.021	.16	< .0004	< .005	< .010	71.2
WNW86-10	DOWN	11/28/90	.013	.092	< .005	.025	2.1	.028	.15	< .0004	< .005	< .005	58.0
WNW86-10	DOWN	12/06/90	.005	.10	.007	.068	5.52	.025	.169	< .0002	< .002	.012	63.9
WNW86-10	DOWN	12/13/90	.007	.15	< .005	.059	11.9	.041	.35	< .0004	< .005	< .005	70.6
WNW86-11	DOWN	02/01/90	.014	.16	.006	.270	41.0	< .005	.78	< .0004	< .005	< .010	65.0
WNW86-11	DOWN	06/07/90	.010	.10	.007	.110	27.8	.027	.47	< .0004	< .005	< .010	60.1
WNW86-11	DOWN	06/21/90	.005	.09	< .005	.019	10.5	.008	.19	< .0004	< .005	< .010	55.2
WNW86-11	DOWN	06/26/90	< .005	.11	< .005	.016	7.3	.014	.13	< .0004	< .005	.015	54.6
WNW86-11	DOWN	09/13/90	< .005	.05	.008	.035	7.5	.020	.20	< .0004	< .005	< .005	66.0
WNW86-11	DOWN	09/27/90	< .005	< .05	< .005	< .010	2.6	.005	.11	< .0004	< .005	< .005	64.8
WNW86-11	DOWN	10/25/90	< .005	< .15	.005	.012	1.9	.007	.11	< .0004	< .005	.012	61.0
WNW86-11	DOWN	11/08/90	< .005	< .15	.009	.012	2.4	.008	.086	< .0004	< .005	< .005	56.4

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

TABLE E - 13

1990 Dissolved Metals for the NRC-licensed Disposal Area Groundwater Monitoring Unit (mg/L)

Location Code	Hydraulic Position	Sample Date	Arsenic	Barium	Cadmium	Chromium	Iron	Lead	Manganese	Mercury	Selenium	Silver	Sodium
Quality Standards¹			.025	1.0	.01	.05	.30	.025	.30	.002	.01	.05	<20
WNW83-1D	UP	06/07/90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WNW83-1D	UP	06/14/90	< .005	.75	.010	.015	< .05	< .005	.12	< .0004	< .005	< .010	18.8
WNW83-1D	UP	06/19/90	< .005	.77	.005	< .010	< .05	< .005	.11	< .0004	< .005	< .010	20.3
WNW83-1D	UP	07/03/90	< .005	.84	< .005	< .010	.06	< .005	.11	< .0004	< .005	< .010	18.9
WNW83-1D	UP	09/24/90	< .005	.84	< .005	< .010	.047	< .003	.12	< .0004	< .005	< .005	19.2
WNW83-1D	UP	10/23/90	< .005	< .10	< .005	< .010	< .05	< .003	.12	< .0004	< .005	< .006	21.8
WNW83-1D	UP	11/08/90	< .005	< .15	< .005	< .010	< .05	< .003	< .007	< .0004	< .005	< .006	18.7
WNW86-10	DOWN	02/01/90	< .005	.07	.005	.012	< .05	< .005	.027	< .0004	< .005	< .010	72.0
WNW86-10	DOWN	06/21/90	< .005	.06	< .005	< .010	< .05	< .005	.024	< .0004	< .005	< .010	80.4
WNW86-10	DOWN	06/26/90	< .005	.07	< .005	< .010	< .05	< .005	.051	< .0004	< .005	.015	87.7
WNW86-10	DOWN	06/28/90	< .005	< .06	< .005	.020	< .05	< .005	.042	< .0004	< .005	< .010	87.3
WNW86-10	DOWN	11/12/90	.005	.05	< .005	< .010	.05	< .003	.042	< .0004	< .005	< .010	72.5
WNW86-10	DOWN	11/28/90	.005	.064	< .005	< .010	< .02	< .003	.038	< .0004	< .005	< .005	68.8
WNW86-10	DOWN	12/06/90	.003	.067	.006	< .010	< .01	< .002	.049	< .0002	< .002	< .010	67.9
WNW86-10	DOWN	12/13/90	< .005	.089	< .005	< .010	< .03	< .003	.14	< .0004	< .005	< .005	70.4
WNW86-11	DOWN	02/01/90	< .005	.05	< .005	.013	< .05	< .005	.06	< .0004	< .005	< .010	67.0
WNW86-11	DOWN	06/07/90	< .005	.06	< .005	.021	< .05	< .005	.038	< .0004	< .005	< .010	72.4
WNW86-11	DOWN	06/21/90	< .005	.06	< .005	< .010	< .05	< .005	.034	< .0004	< .005	< .010	73.2
WNW86-11	DOWN	06/26/90	< .005	.07	< .005	< .010	< .05	< .005	.046	< .0004	< .005	.012	71.1
WNW86-11	DOWN	09/13/90	< .005	< .05	< .005	< .010	< .02	< .003	.078	< .0004	< .005	< .005	66.4
WNW86-11	DOWN	09/27/90	< .005	< .05	< .005	< .010	< .02	< .003	.053	< .0004	< .005	< .005	63.1
WNW86-11	DOWN	10/25/90	< .005	< .10	< .005	< .010	< .05	< .003	.069	< .0004	< .005	< .006	67.1
WNW86-11	DOWN	11/08/90	< .005	< .15	< .005	< .010	< .05	< .003	.041	< .0004	< .005	< .005	61.6

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

N/A Not available

TABLE E - 14

1990 Radioactivity Concentrations in the NRC-licensed Disposal Area
Groundwater Monitoring Unit ($\mu\text{Ci/mL}$)

Location Code	Hydraulic Position	Sample Date	Gross Alpha	Gross Beta	Tritium	Cs-137	Co-60
****Department of Energy DCGs****			3.0E-08	1.0E-06	2.0E-03	3.0E-06	5.0E-06
****Quality Standards ¹ ****			1.5E-08	1.0E-06	2.0E-05	N/A	N/A
WNW83-1D	UP	06/07/90	< 1.10E-09	2.71±1.77E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW83-1D	UP	06/14/90	< 1.25E-09	3.88±1.75E-09	3.25±1.16E-07	< 3.7E-08	< 3.8E-08
WNW83-1D	UP	06/19/90	< 1.21E-09	< 1.63E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW83-1D	UP	07/03/90	< 1.26E-09	1.99±1.56E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW83-1D	UP	09/24/90	< 7.40E-10	3.75±1.22E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW83-1D	UP	10/23/90	< 8.01E-10	< 1.74E-09	1.35±1.13E-07	< 3.7E-08	< 3.8E-08
WNW83-1D	UP	11/08/90	< 1.51E-09	2.65±1.62E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-10	DOWN	02/01/90	< 2.94E-09	5.38±2.29E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-10	DOWN	06/21/90	< 3.33E-09	4.31±2.10E-09	2.18±1.13E-07	< 3.7E-08	< 3.8E-08
WNW86-10	DOWN	06/26/90	< 3.61E-09	7.53±2.41E-09	5.85±1.22E-07	< 3.7E-08	< 3.8E-08
WNW86-10	DOWN	06/28/90	1.11±.87E-08	8.82±2.52E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-10	DOWN	11/12/90	< 4.32E-09	6.91±2.22E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-10	DOWN	11/28/90	< 1.88E-09	5.29±2.19E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-10	DOWN	12/06/90	< 1.29E-08	8.90±2.77E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-10	DOWN	12/13/90	< 2.66E-09	8.38±2.44E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-11	DOWN	02/01/90	< 1.25E-08	< 2.29E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-11	DOWN	06/07/90	< 6.86E-09	3.87±2.09E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-11	DOWN	06/21/90	< 4.59E-09	5.10±2.26E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-11	DOWN	06/26/90	< 8.38E-09	4.07±2.10E-09	2.03±1.15E-07	< 3.7E-08	< 3.8E-08
WNW86-11	DOWN	09/13/90	4.37±4.28E-09	4.38±2.18E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-11	DOWN	09/27/90	< 2.97E-09	5.08±1.48E-09	< 1.00E-07	< 3.7E-08	< 3.8E-08
WNW86-11	DOWN	10/25/90	< 4.51E-09	2.41±2.22E-09	1.24±1.11E-07	< 3.7E-08	< 3.8E-08
WNW86-11	DOWN	11/08/90	< 4.72E-09	5.49±2.21E-09	< 1.57E-07	< 3.7E-08	< 3.8E-08

¹ Quality standards for Class GA Groundwater are from 6 NYCRR Part 703.5

N/A Not available

TABLE E - 15

Summary of Initial Sampling of Selected New 90-series Groundwater Monitoring Wells ($\mu\text{Ci/mL}$)

Location Code	Hydraulic Position	Sample Date	pH	Conductivity*	Alpha	Beta	Tritium
WNW0103	UP	12/27/90	12.33	16,520	<1.05E-07	<5.68E-08	5.47 \pm 0.76E-07
WNW0104	UP	12/21/90	7.21	882	<3.54E-09	7.23 \pm 0.21E-07	1.19 \pm 0.10E-06
WNW0105	DOWN	12/21/90	7.12	784	6.37 \pm 5.58E-09	1.11 \pm 0.37E-08	9.11 \pm 0.93E-07
WNW0106	DOWN	12/28/90	7.15	1573	<1.16E-08	5.31 \pm 3.57E-09	1.83 \pm 0.12E-06
WNW0107	DOWN	12/21/90	7.35	1003	1.32 \pm 0.82E-08	9.69 \pm 3.58E-09	1.85 \pm 0.12E-06
WNW0108	DOWN	12/27/90	7.71	900	<4.97E-09	5.53 \pm 3.10E-09	<1.00E-07
WNW0109	DOWN	12/26/90	7.47	670	<3.65E-09	<2.56E-09	9.24 \pm 0.93E-07
WNW0110	DOWN	12/26/90	7.55	519	<2.53E-09	6.85 \pm 3.04E-09	5.72 \pm 0.92E-07
WNW0111	DOWN	12/28/90	6.60	786	3.65 \pm 3.39E-09	3.39 \pm 0.04E-06	2.23 \pm 0.13E-06
WNW0114	DOWN	12/21/90	7.51	495	3.73 \pm 3.46E-09	3.81 \pm 2.72E-09	3.36 \pm 0.85E-07
WNW0115	DOWN	12/28/90	8.04	398	<2.18E-09	5.13 \pm 2.75E-09	4.75 \pm 0.86E-07
WNW0116	DOWN	12/28/90	7.48	1267	<6.53E-09	1.03 \pm 0.38E-08	1.45 \pm 0.11E-06
WNW0701	UP	12/28/90	7.60	769	<3.19E-09	<2.55E-09	<1.00E-07
WNW0702	DOWN	12/28/90	7.59	203	7.74 \pm 7.19E-09	5.18 \pm 3.09E-09	<1.00E-07
WNW0703	DOWN	12/26/90	7.54	871	<2.991E-09	4.82 \pm 2.88E-09	<1.00E-07
WNW0704	DOWN	12/26/90	6.60	1175	1.27 \pm 1.18E-08	1.58 \pm 0.42E-08	<1.00E-07
WNW0705	DOWN	12/21/90	7.48	462	3.94 \pm 3.09E-09	<2.48E-09	<1.00E-07
WNW0706	UP	12/28/90	6.66	619	<2.28E-09	7.31 \pm 3.02E-09	<1.00E-07
WNW0707	DOWN	12/28/90	7.27	384	<2.11E-09	5.29 \pm 2.75E-09	<1.00E-07
WNW0801	UP	12/21/90	6.88	801	4.17 \pm 3.65E-09	1.82 \pm 0.11E-07	9.59 \pm 0.93E-07
WNW0802	DOWN	12/21/90	6.66	230	<1.17E-09	<2.24E-09	3.19 \pm 0.82E-07
WNW0803	DOWN	12/21/90	6.96	1081	8.91 \pm 7.81E-09	8.96 \pm 3.64E-09	1.44 \pm 0.11E-06
WNW0804	DOWN	12/28/90	6.80	633	<1.80E-09	2.00 \pm 0.41E-08	3.21 \pm 0.83E-07

* Measured in $\mu\text{mhos/cm}@25^{\circ}\text{C}$

TABLE E - 16

1990 Radioactivity Concentrations in the NYS - licensed Disposal Area Groundwater Monitoring Unit

Well ID	Sample Date	Gross Alpha ($\mu\text{Ci/mL}$)	Gross Beta ($\mu\text{Ci/mL}$)	Tritium ($\mu\text{Ci/mL}$)	pH	Conductivity ¹
*1101A	12/17/90	<3.10E-09	4.19 \pm 2.99E-09	<1.0E-07	7.30	763
*1101B	12/17/90	<6.63E-09	3.26 \pm 3.10E-09	<1.0E-07	7.30	945
*1101C	12/18/90	<3.45E-09	1.31 \pm 0.37E-08	<1.0E-07	7.78	465
1102A	12/17/90	6.83 \pm 5.80E-09	5.29 \pm 3.01E-09	<1.0E-07	7.07	838
1102B	12/18/90	3.70 \pm 2.74E-09	3.10 \pm 2.68E-09	<1.0E-07	7.24	554
1103A	12/20/90	<4.99E-09	3.20 \pm 3.04E-09	8.35 \pm 0.90E-07	7.27	873
1103B	12/20/90	3.31 \pm 2.90E-09	5.96 \pm 3.03E-09	<1.0E-07	7.35	686
1103C	12/20/90	**	**	<1.53E-07	**	**
1104A	12/20/90	<3.92E-09	5.71 \pm 3.15E-09	2.20 \pm 0.81E-07	7.29	757
1104B	12/20/90	<4.23E-09	5.47 \pm 3.18E-09	<1.0E-07	7.43	804
1104C	12/20/90	**	**	<1.0E-07	7.67	1978
1105A	12/26/90	7.16 \pm 4.23E-09	<2.67E-09	<1.0E-07	7.59	795
1105B	12/26/90	6.28 \pm 4.10E-09	5.13 \pm 2.97E-09	<1.0E-07	7.67	833
*1106A	12/20/90	<7.14E-09	1.07 \pm 0.38E-08	8.88 \pm 0.93E-07	7.19	1051
*1106B	12/20/90	<6.25E-09	5.09 \pm 3.21E-09	1.33 \pm 0.80E-07	7.31	877
1107A	10/26/90	2.14 \pm 1.10E-08	1.17 \pm 0.30E-08	2.57 \pm 0.08E-05	6.77	1254
1107A	12/18/90	1.51 \pm 1.12E-08	5.57 \pm 3.48E-09	2.78 \pm 0.15E-05	6.52	1223
*1108A	12/20/90	<1.14E-08	1.26 \pm 0.44E-08	<1.0E-07	7.04	1592
*1109A	12/26/90	3.92 \pm 3.14E-09	4.21 \pm 2.86E-09	3.24 \pm 0.84E-07	7.58	762
*1109B	12/26/90	<1.10E-09	2.57 \pm 2.53E-09	2.42 \pm 0.84E-07	8.08	418
1110A	12/20/90	<7.15E-09	1.25 \pm 0.44E-08	<1.0E-07	6.90	1735
1111A	12/18/90	7.74 \pm 6.19E-09	7.40 \pm 3.42E-09	<1.0E-07	6.98	1000

¹ Measured in $\mu\text{mhos/cm}@25^{\circ}\text{C}$

* Upgradient wells

** Volume too low for sample analysis

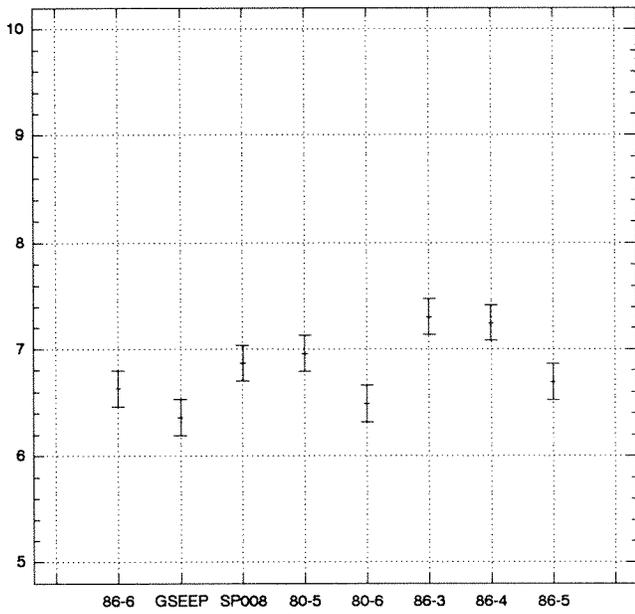


Figure E - 1.
pH in groundwater samples from the low-level liquid waste treatment facility. Well 86-6 is upgradient.

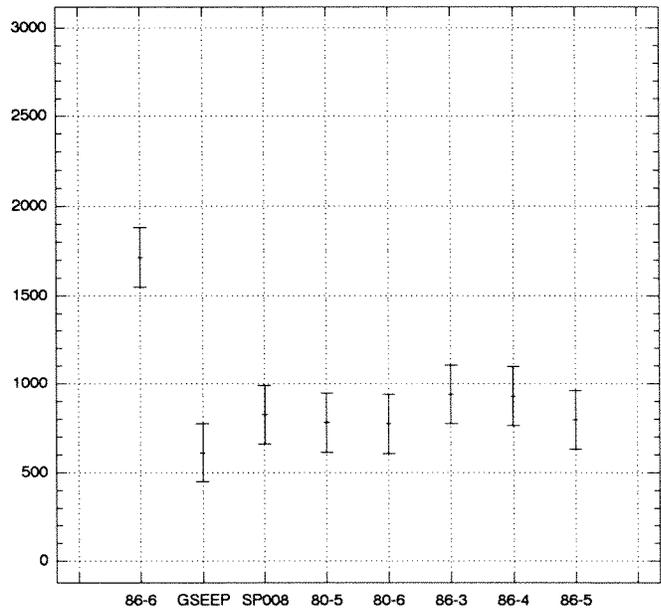


Figure E - 2.
Conductivity (umhos/cm at 25°C) in groundwater samples from the low-level liquid waste treatment facility. Well 86-6 is upgradient.

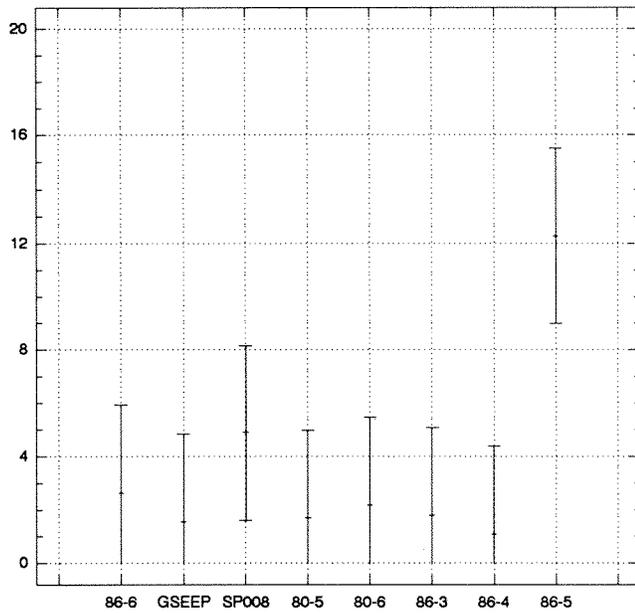


Figure E - 3.
Total organic carbon (mg/L) in groundwater samples from the low-level liquid waste treatment facility. Well 86-6 is upgradient.

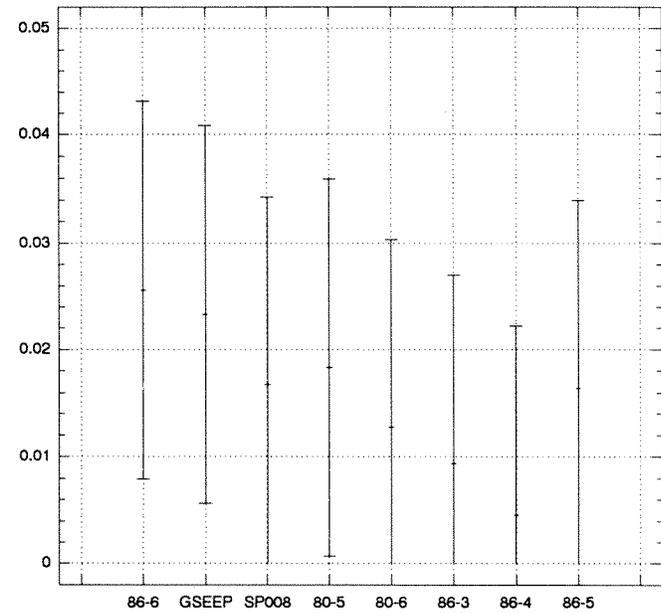


Figure E - 4.
Total organic halogens (mg/L) in groundwater samples from the low-level liquid waste treatment facility. Well 86-6 is upgradient.

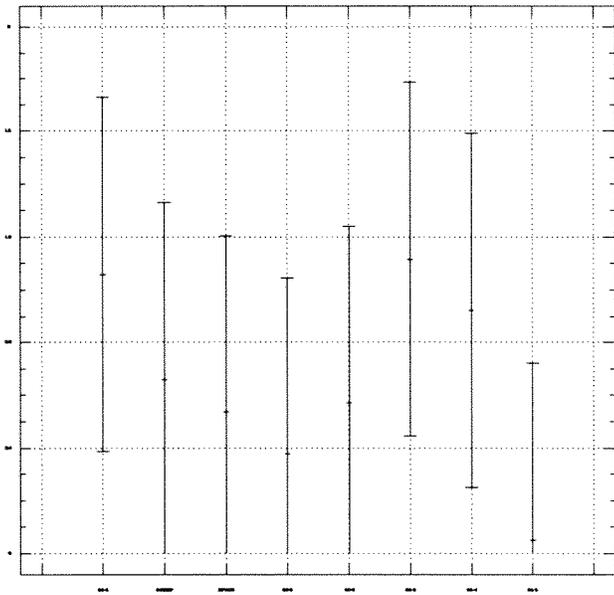
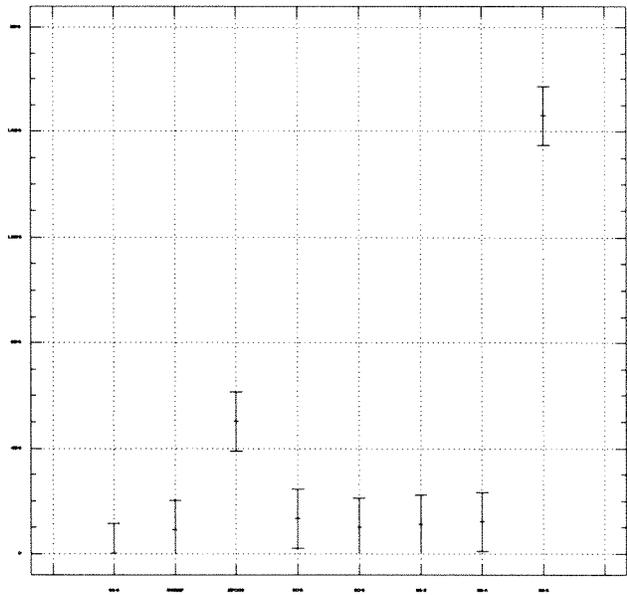


Figure E - 5.
Nitrate - N (mg/L) in groundwater samples from the low-level liquid waste treatment facility. Well 86-6 is upgradient.



Fgiure E - 6.
Tritium activity ($\mu\text{Ci/mL}$) in groundwater samples from the low-level liquid waste treatment facility. Well 86-6 is upgradient. Figure E - 7 follows without well 86-5 to provide adequate scaling.

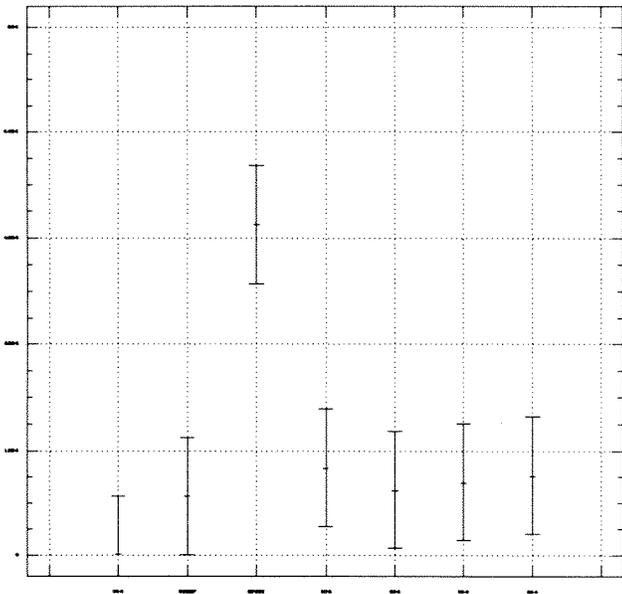


Figure E - 7.
Tritium activity ($\mu\text{Ci/mL}$) in groundwater samples from the low-level liquid waste treatment facility without well 86-5.

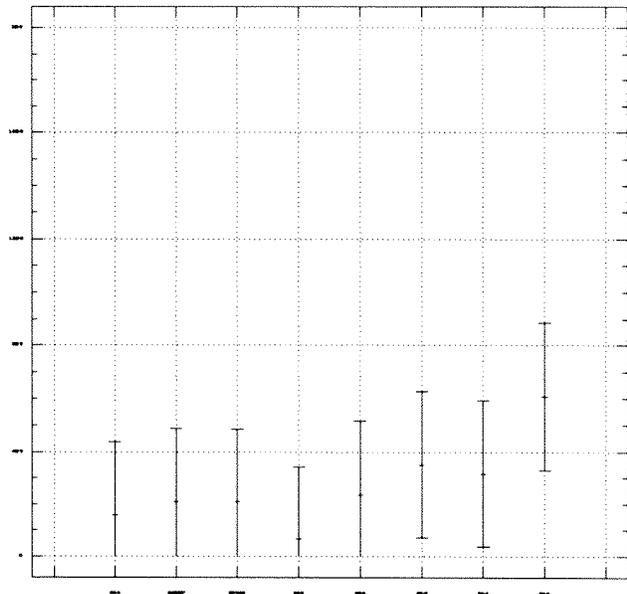


Figure E - 8.
Gross alpha activity ($\mu\text{Ci/mL}$) in groundwater samples from the low-level liquid waste treatment facility. Well 86-6 is upgradient.

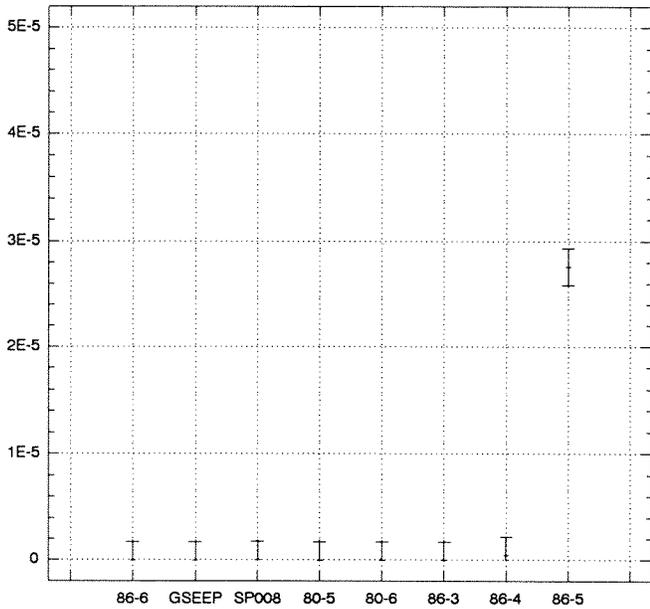


Figure E - 9.
Gross beta activity ($\mu\text{Ci}/\text{mL}$) in groundwater samples from the low-level liquid waste treatment facility. Well 86-6 is upgradient. Figure E - 10 follows without well 86-5 to provide adequate scaling.

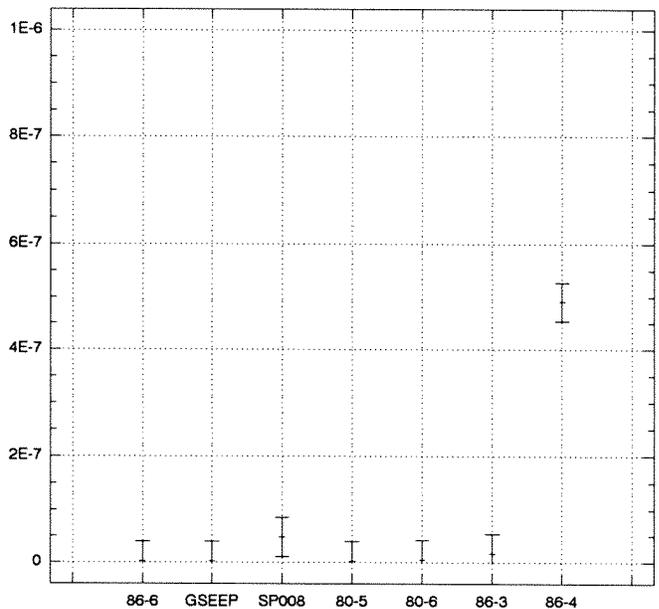


Figure E - 10.
Gross beta activity ($\mu\text{Ci}/\text{mL}$) in groundwater samples from the low-level liquid waste treatment facility without well 86-5 .

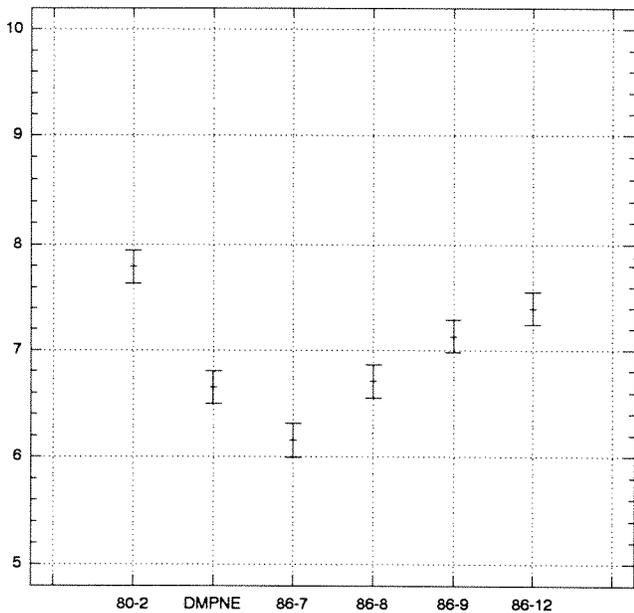


Figure E - 11.
pH in groundwater samples from the high-level waste storage and processing area. Well 80-2 is upgradient.

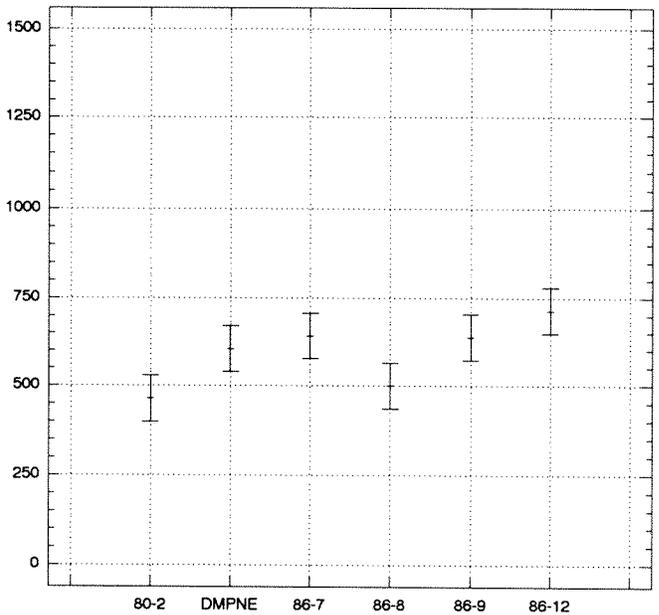


Figure E - 12.
Conductivity ($\mu\text{mhos}/\text{cm}$ at 25°C) in groundwater samples from the high-level waste processing and storage area. Well 80-2 is upgradient.

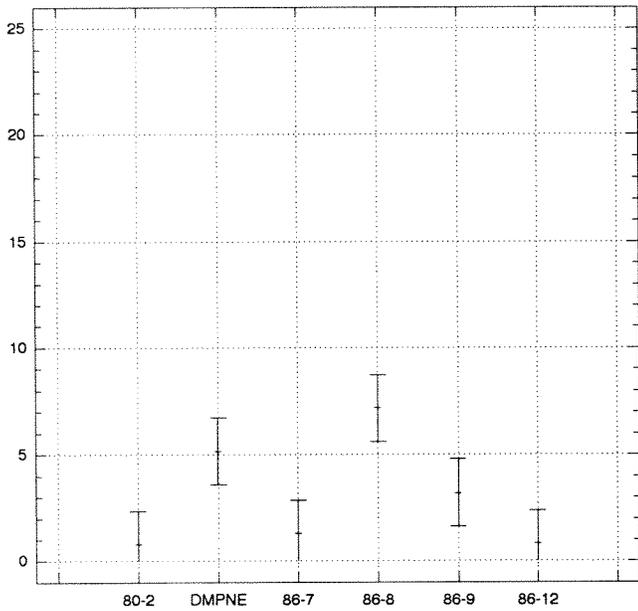


Figure E - 13.
Total organic carbon (mg/L) in groundwater samples from the high-level waste storage and processing area. Well 80-2 is upgradient.

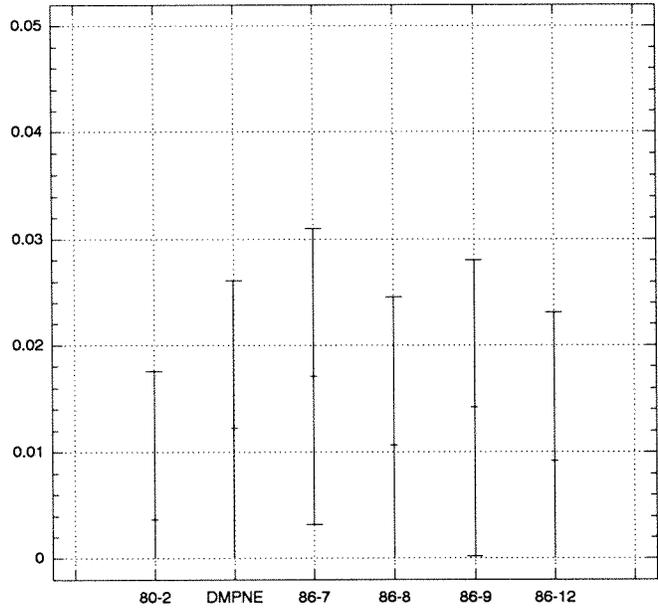


Figure E - 14.
Total organic halogens (mg/L) in groundwater samples from the high-level waste storage and processing area. Well 80-2 is upgradient.

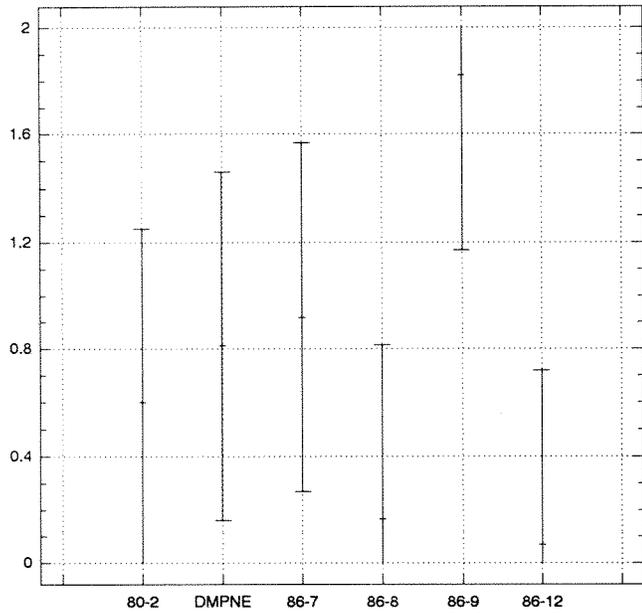


Figure E - 15.
Nitrate-N (mg/L) in groundwater samples from the high-level waste storage and processing area. Well 80-2 is upgradient.

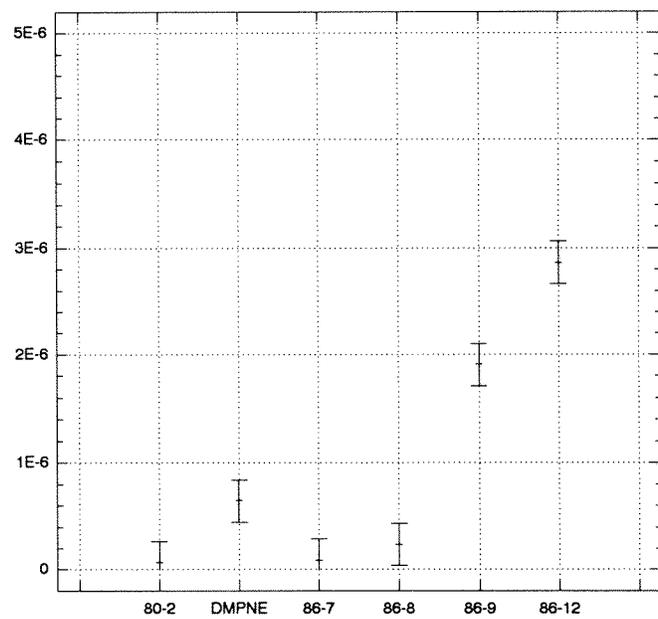


Figure E - 16.
Tritium activity (μCi/mL) in groundwater samples from the high-level waste storage and processing area. Well 80-2 is upgradient.

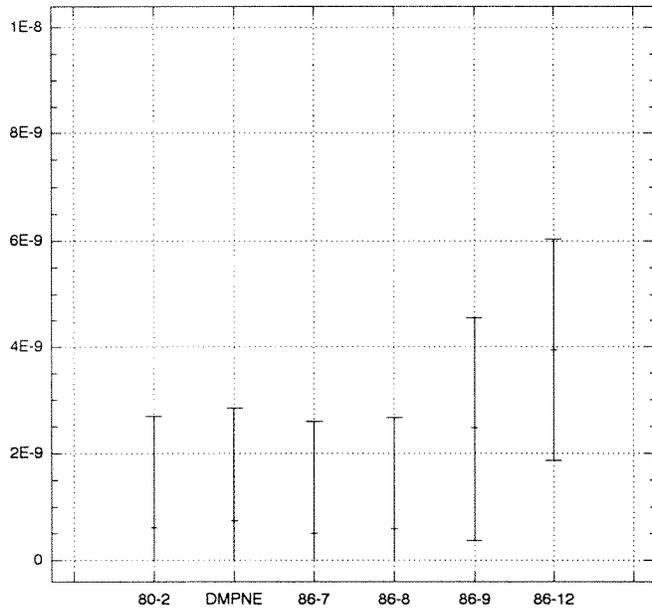


Figure E - 17.
Gross alpha activity ($\mu\text{Ci/mL}$) in groundwater samples from the high-level waste storage and processing area. Well 80-2 is upgradient.

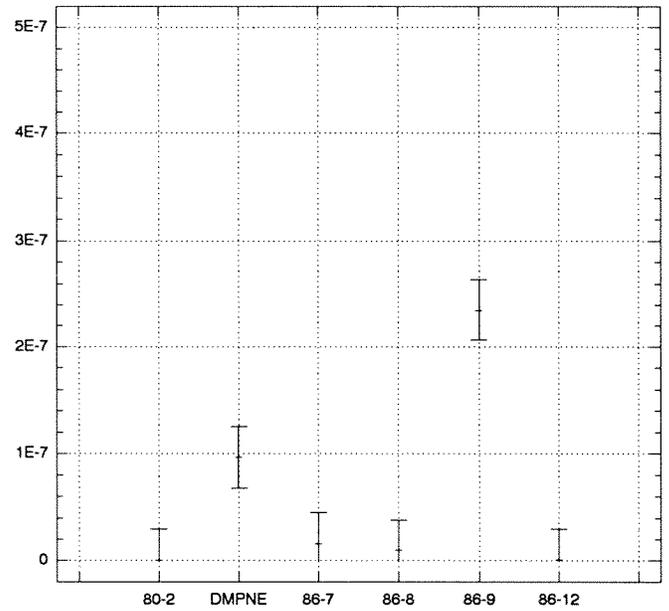


Figure E - 18.
Gross beta activity ($\mu\text{Ci/mL}$) in groundwater samples from the high-level waste storage and processing area. Well 80-2 is upgradient.

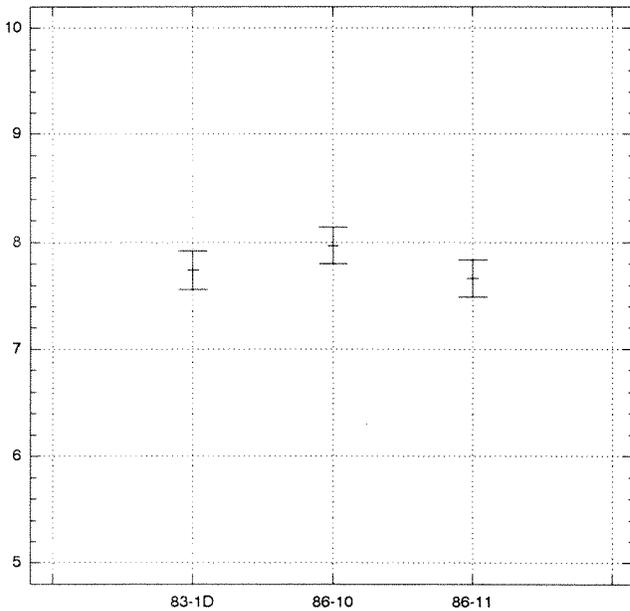


Figure E - 19.
pH in groundwater samples from the NRC-licensed disposal area monitoring unit. Well 83-1D is upgradient.

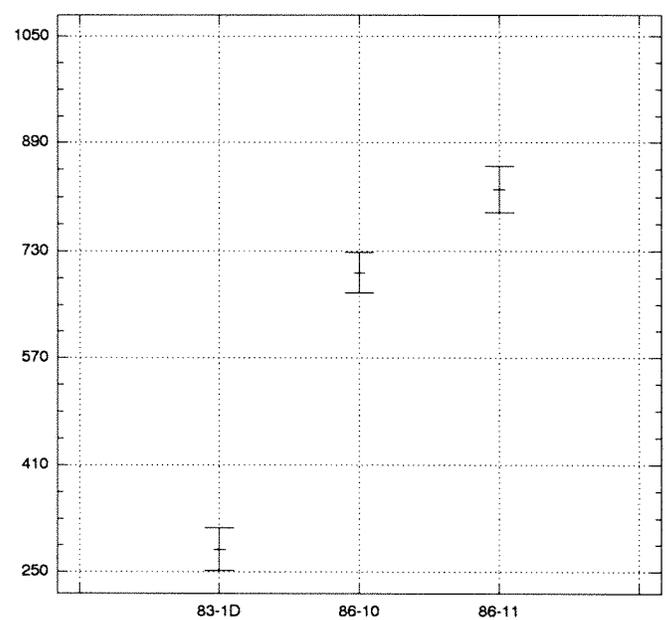


Figure E - 20.
Conductivity ($\mu\text{mhos/cm}$ at $25\text{ }^\circ\text{C}$) in groundwater samples from the NRC-licensed disposal area monitoring unit. Well 83-1D is upgradient.

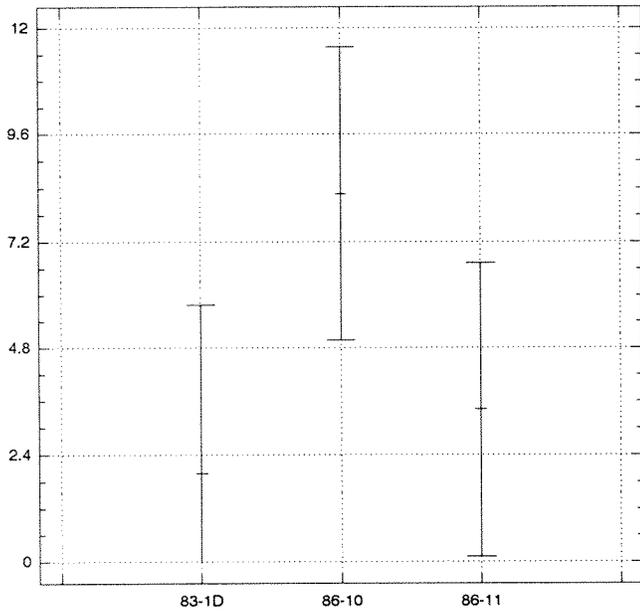


Figure E - 21.
Total organic carbon (mg/L) in groundwater samples from the NRC-licensed disposal area monitoring unit. Well 83-1D is upgradient.

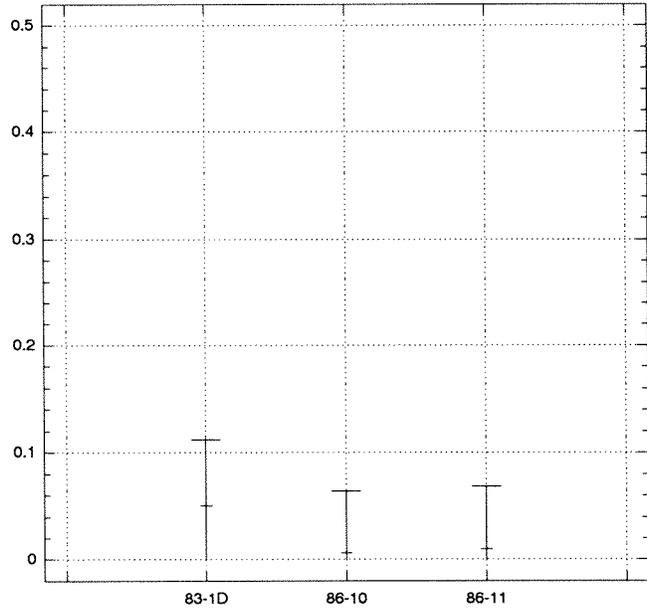


Figure E - 22.
Total organic halogens (mg/L) in groundwater samples from the NRC-licensed disposal area monitoring unit. Well 83-1D is upgradient.

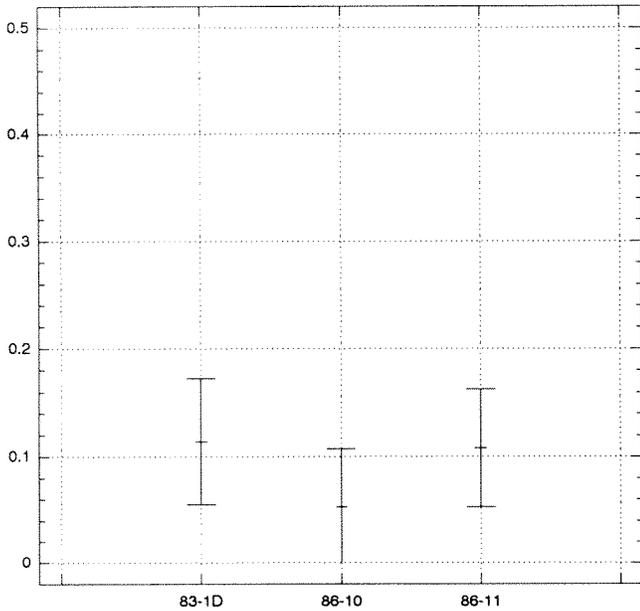


Figure E - 23.
Nitrate-N (mg/L) in groundwater samples from the NRC-licensed disposal area monitoring unit. Well 83-1D is upgradient.

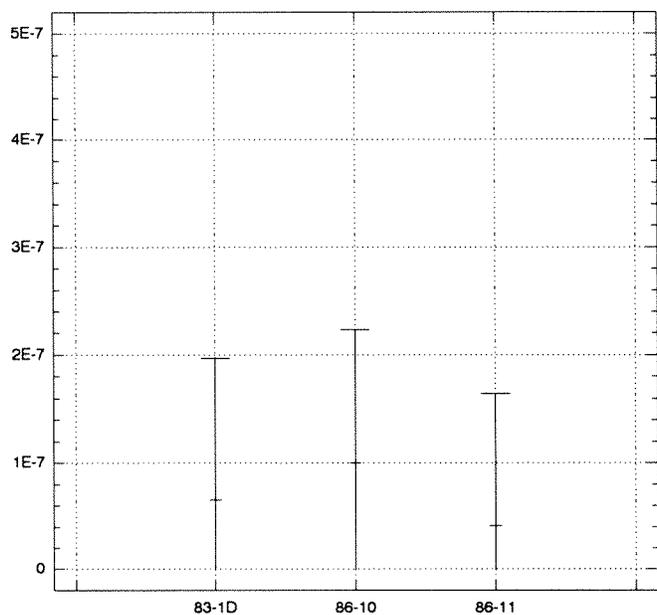


Figure E - 24.
Tritium activity (μCi/mL) in groundwater samples from the NRC-licensed disposal area monitoring unit. Well 83-1D is upgradient.

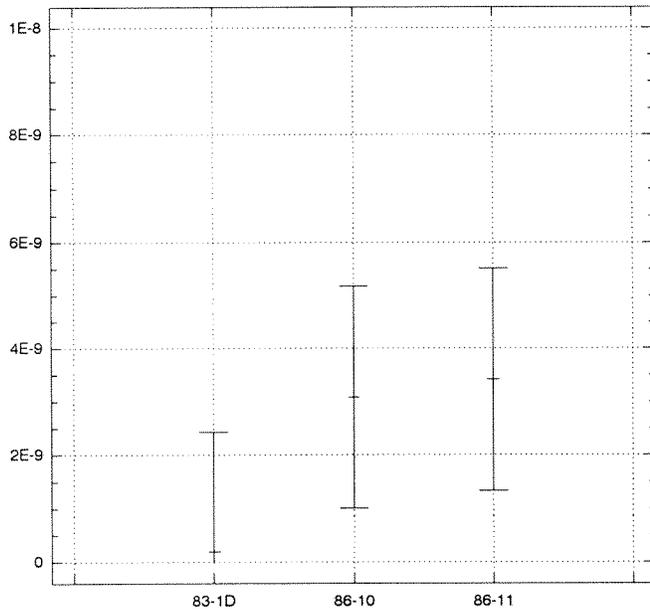


Figure E - 25.
Gross alpha activity ($\mu\text{Ci/mL}$) in groundwater samples from the NRC-licensed disposal area monitoring unit. Well 83-1D is upgradient.

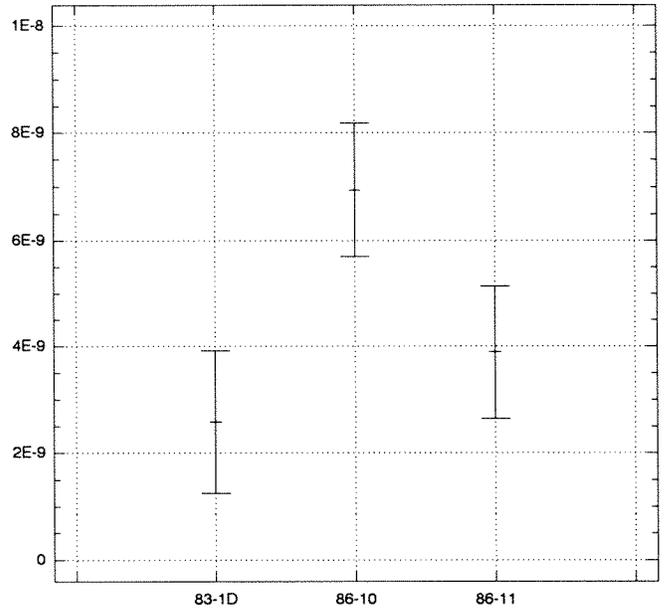


Figure E - 26.
Gross beta activity ($\mu\text{Ci/mL}$) in groundwater samples from the NRC-licensed disposal area monitoring unit. Well 83-1D is upgradient.

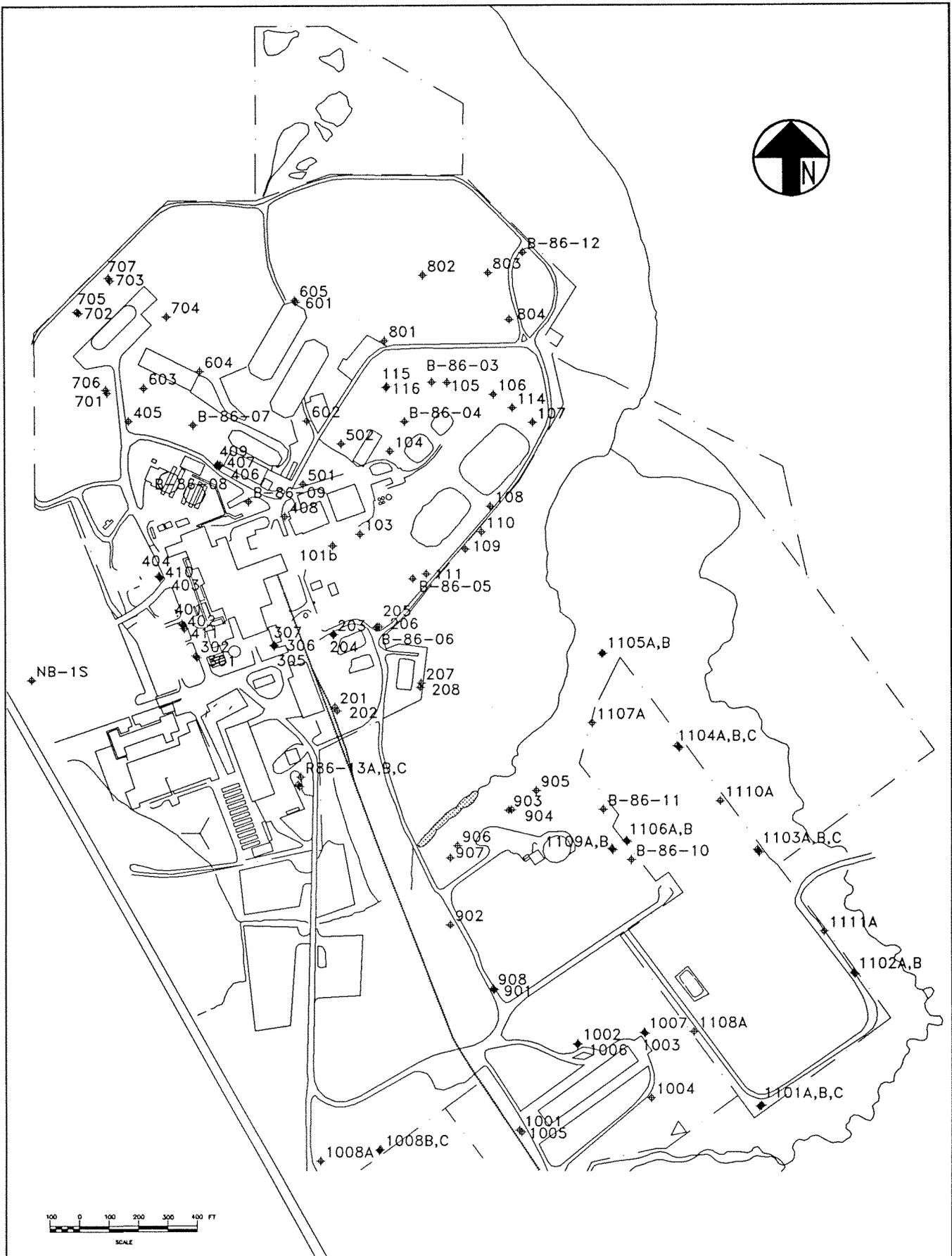


Figure E-27. Location of On-site Groundwater Network Wells Including 1990 Installations

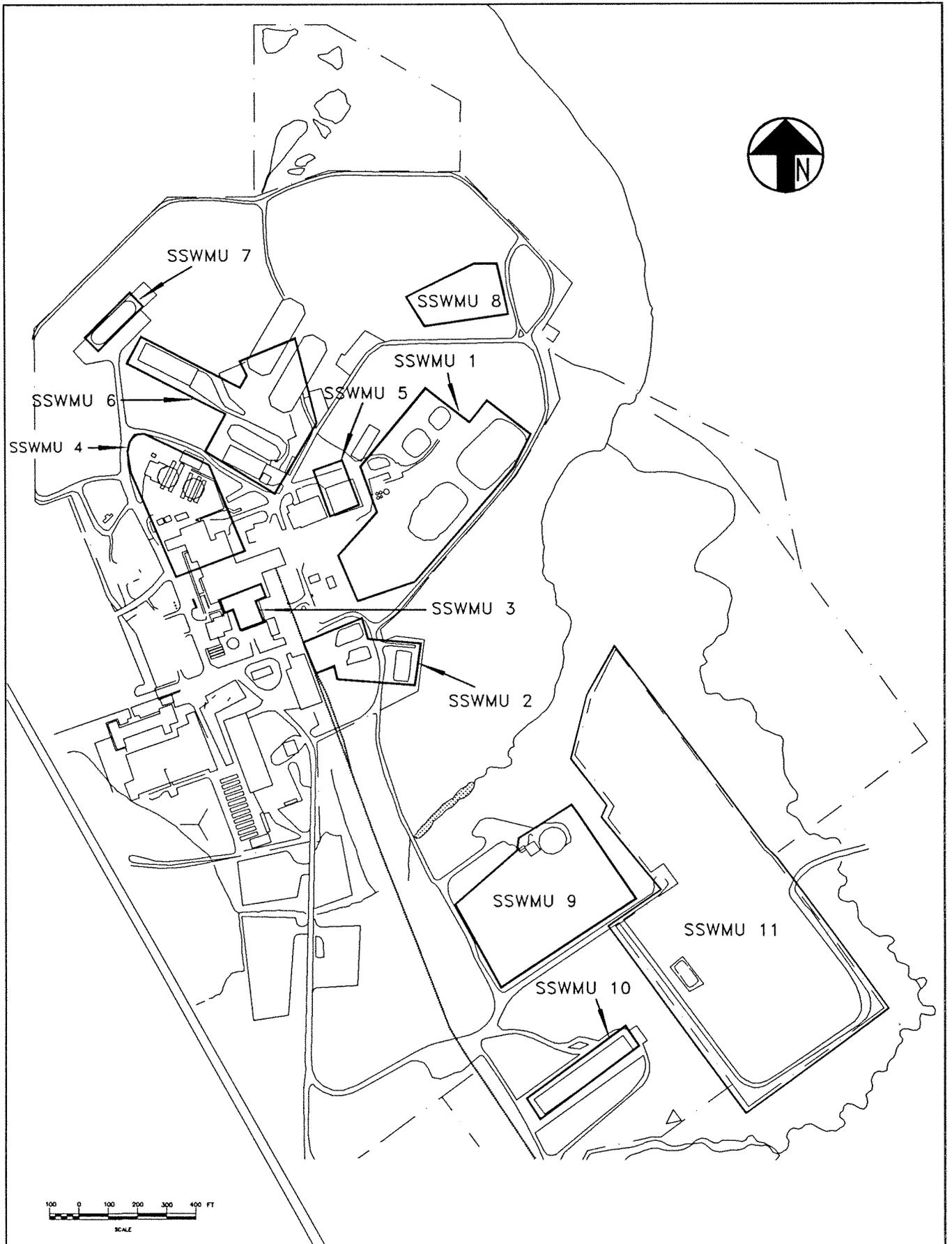


Figure E-28. Location of Super Solid Waste Management Units near WVDP Facilities.

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Glossary

ALLUVIUM. Sedimentary material deposited by flowing water such as a river.

ALLUVIAL FAN. A cone-shaped deposit of alluvium made by a stream where it runs out onto a level plain.

AQUIFER. A water-bearing unit of permeable rock or soil that will yield water in usable quantities to wells. *Confined aquifers* are bounded above and below by less permeable layers. Groundwater in a confined aquifer is under a pressure greater than the atmospheric pressure. *Unconfined aquifers* are bounded below by less permeable material, but are not bounded above. The pressure on the groundwater in an unconfined aquifer at the top of the aquifer is equal to that of the atmosphere.

AQUITARD. A relatively impervious and semiconfining geologic formation which, compared to an aquifer, transmits water at a very slow rate .

BACKGROUND RADIATION. Includes both natural and manmade radiation such as cosmic radiation and radiation from naturally radioactive elements and from commercial sources and medical procedures.

BECQUEREL (BQ). A unit of radioactivity equal to one nuclear transformation per second.

CLASS A, B, AND C LOW-LEVEL WASTE. Waste classifications from the Nuclear Regulatory Commission's 10 CFR Part 61 rule. Maximum concentration limits are set for specific isotopes. Class A waste disposal is minimally restricted with respect to the form of the waste. Class B waste must meet more rigorous requirements to ensure physical stability after disposal. Greater concentration limits are set for the same isotopes in Class C waste, which also must meet physical stability requirements. Moreover, special measures must be taken at the disposal facility to protect against inadvertent intrusion.

CONFIDENCE COEFFICIENT OR FACTOR. The chance or probability, usually expressed as a percentage, that a confidence interval includes some defined parameter of a population. The confidence coefficients usually associated with confidence intervals are 90%, 95%, and 99%.

COSMIC RADIATION. High-energy subatomic particles from outer space that bombard the earth's atmosphere. Cosmic radiation is part of natural background radiation.

COUNTING ERROR. The variability caused by the inherent random nature of radioactive disintegration and the detection process.

CURIE (Ci). A unit of radioactivity equal to 37 billion (3.7×10^{10}) nuclear transformations per second.

DETECTION LEVEL. The minimum concentration of a substance that can be measured with a 99% confidence that the analytical concentration is greater than zero.

DERIVED CONCENTRATION GUIDE (DCG). Concentrations of radionuclides in air and water in which a person continuously exposed and inhaling 8400 m³ of air or ingesting 730 liters of water per year would receive an annual effective dose equivalent of 100 mrem per year from either mode of

Glossary

exposure. The committed dose equivalent is included in the DCGs for radionuclides with long half-lives (see appendix B).

DISPERSION. The process whereby solutes are spread or mixed as they are transported by groundwater as it moves through sediments.

DOSIMETER. A portable device for measuring the total accumulated exposure to ionizing radiation.

DOWNGRADIENT. The direction of water flow from a reference point to a selected point of interest (see GRADIENT).

EFFECTIVE DOSE. See EFFECTIVE DOSE EQUIVALENT under RADIATION DOSE.

EFFLUENT. Flowing out or forth; an outflow of waste. In this report, effluent refers to the liquid or gaseous waste streams released into the environment from the facility.

EFFLUENT MONITORING. Sampling or measuring specific liquid or gaseous effluent streams for the presence of pollutants.

EXPOSURE. Subjecting a target (usually living tissue) to radiation.

FALLOUT. Radioactive materials mixed into the earth's atmosphere. Fallout constantly precipitates onto the earth.

GRADIENT. Change in value of one variable with respect to another variable, especially vertical or horizontal distance.

GROUNDWATER. Subsurface water in the pore spaces of soil and geologic units.

HALF-LIFE. The time in which half the atoms of a radionuclide disintegrate into another nuclear form. The half-life may vary from a fraction of a second to thousands of years.

HIGH-LEVEL WASTE (HLW). The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations sufficient to require permanent isolation.

HYDRAULIC CONDUCTIVITY. The ratio of flow velocity to driving force for viscous flow under saturated conditions of a specified liquid in a porous medium; the ratio describing the rate at which water can move through a permeable medium.

ION. An atom or group of atoms with an electric charge.

ION EXCHANGE. The reversible exchange of ions contained in solution with other ions that are part of the ion-exchange material.

ISOTOPE. Different forms of the same chemical element that are distinguished by having different numbers of neutrons in the nucleus. An element can have many isotopes. For example, the three isotopes of hydrogen are protium, deuterium, and tritium.

Glossary

KAME DELTA. A conical hill or short irregular ridge of gravel or sand deposited in contact with glacier ice.

LACUSTRINE SEDIMENTS. A sedimentary deposit consisting of material pertaining to, produced by, or formed in a lake or lakes.

LEACHED HULLS. Stainless steel cladding that remains after acid dissolution of spent fuel.

LOW-LEVEL WASTE. Radioactive waste not classified as high-level waste, transuranic waste, spent fuel, or uranium mill tailings (see CLASS A,B,C LOW-LEVEL WASTE).

MAXIMALLY EXPOSED INDIVIDUAL. A hypothetical person who remains in an uncontrolled area who would, when all potential routes of exposure from a facility's operations are considered, receive the greatest possible dose equivalent.

MEAN. The average value of a series of measurements.

MILLIREM (MREM). A unit of radiation dose equivalent that is equal to one one-thousandth of a rem. An individual member of the public can receive up to 500 millirems per year according to DOE standards. This limit does not include radiation received for medical treatment or the 100 to 360 mrem that people receive annually from background radiation.

MINIMUM DETECTABLE CONCENTRATION. The smallest amount or concentration of a radioactive or nonradioactive element that can be reliably detected in a sample.

MIXED WASTE. A waste that is both radioactive and hazardous. Also referred to as RADIOACTIVE MIXED WASTE (RMW).

OUTFALL. The end of a drain or pipe that carries waste water or other effluents into a ditch, pond, or river.

PARTICULATES. Solid particles and liquid droplets small enough to become airborne.

PERSON-REM. The sum of the individual radiation dose equivalents received by members of a certain group or population. It may be calculated by multiplying the average dose per person by the number of persons exposed. For example, a thousand people each exposed to one millirem would have a collective dose of one person-rem.

PLUME. The distribution of a pollutant in air or water after being released from a source.

PROGLACIAL LAKE. A lake occupying a basin in front of a glacier; generally in direct contact with the ice.

RAD. Radiation absorbed dose. One hundred ergs of energy absorbed per gram.

RADIATION. The process of emitting energy in the form of rays or particles that are thrown off by disintegrating atoms. The rays or particles emitted may consist of alpha, beta, or gamma radiation.

Glossary

- **ALPHA RADIATION.** The least penetrating type of radiation. Alpha radiation can be stopped by a sheet of paper or outer dead layer of skin.
- **BETA RADIATION.** Electron emitted from a nucleus during fission and nuclear decay. Beta radiation can be stopped by an inch of wood or a thin sheet of aluminum.
- **GAMMA RADIATION.** A form of electromagnetic, high-energy radiation emitted from a nucleus. Gamma rays are essentially the same as x-rays and require heavy shielding such as lead, concrete, or steel to be stopped.
- **INTERNAL RADIATION.** Radiation originating from a source within the body as a result of the inhalation, ingestion, or implantation of natural or manmade radionuclides in body tissues.

RADIATION DOSE.

- **ABSORBED DOSE.** The amount of energy deposited by radiation in a given amount of material. Absorbed dose is measured in rads.
- **COLLECTIVE DOSE EQUIVALENT.** The sum of the dose equivalents for individuals comprising a defined population. The per capita dose equivalent is the quotient of the collective dose equivalent divided by the population (see PERSON-REM).
- **COMMITTED DOSE EQUIVALENT (CDE).** The effective dose equivalent from an intake of radionuclides delivered over a period of 50 years following the intake.
- **CUMULATIVE DOSE EQUIVALENT.** The total dose one could receive in a period of fifty years following release of radionuclides to the environment, including the dose that could occur as a result of residual radionuclides remaining in the environment beyond the year of release.
- **DOSE EQUIVALENT.** The product of the absorbed dose, the quality factor, and any other modifying factors. The dose equivalent is a quantity for comparing the biological effectiveness of different kinds of radiation on a common scale. The unit of dose equivalent is the rem.
- **EFFECTIVE DOSE EQUIVALENT.** The sum over all organs of dose equivalents (from internal and external radiation) to each organ, multiplied by the appropriate weighting factor for that organ.

RADIOACTIVITY. A property possessed by some elements such as uranium whereby alpha, beta, or gamma rays are spontaneously emitted.

RADIOISOTOPE. A radioactive isotope of a specified element. Carbon-14 is a radioisotope of carbon. Tritium is a radioisotope of hydrogen.

Glossary

RADIONUCLIDE. A radioactive nuclide. Radionuclides are variations (isotopes) of elements. They have the same number of protons and electrons but different numbers of neutrons, resulting in

different atomic masses. There are several hundred known nuclides, both manmade and naturally occurring.

REM. An acronym for Roentgen Equivalent Man. A unit of radiation exposure that indicates the potential effect on human cells.

SIEVERT. A unit of dose equivalent from the International System of Units. Equal to one joule per kilogram.

SPENT FUEL. Nuclear fuel that has been exposed in a nuclear reactor; this fuel contains uranium, activation products, fission products, and plutonium.

STANDARD DEVIATION. An indication of the dispersion of a set of results around their average.

THERMOLUMINESCENT DOSIMETER (TLD). A device that luminesces upon heating after being exposed to radiation. The amount of light emitted is proportional to the amount of radiation to which the luminescent material has been exposed.

UPGRADIENT. Referring to the flow of water or air, it is analogous to upstream. A point that is "before" an area of study that is used as a baseline for comparison with downstream data. See **GRADIENT** and **DOWNGRADIENT**.

WATERSHED. The area contained within a drainage divide above a specified point on a stream.

WATER TABLE. The upper surface in a body of groundwater. The surface in an unconfined aquifer or confining bed at which the pore water pressure is equal to atmospheric pressure.

WHOLE-BODY DOSE. A radiation dose that involves exposure of the entire body.

Acronyms

ANOVA. Analysis of Variance

ALARA. As Low As Reasonably Achievable

BEIR. Committee on Biological Effects of Ionizing Radiation

CDDL. Construction and Demolition Debris Landfill (formerly the “cold dump”)

CERCLA. Comprehensive Environmental Response, Compensation, and Liability Act

CSS. Cement Solidification System

DCG. Derived Concentration Guide

DE. Dose Equivalent

DOE. Department of Energy

DOE-HQ. Department of Energy, Headquarters Office

DOE-ID. Department of Energy, Idaho Operations

EA. Environmental Assessment

EDE. Effective Dose Equivalent

EE. Environmental Evaluation

EIS. Environmental Impact Statement

ELAP. Environmental Laboratory Accreditation Program

EML. Environmental Measurements Laboratory

EMSL. Environmental Monitoring Systems Laboratory (Las Vegas)

EPA. Environmental Protection Agency

FONSI. Finding of No Significant Impact

FSFCA. Federal and State Facilities Compliance Agreement

FY. Fiscal Year

HLW. High-level Radioactive Waste

ICRP. International Commission on Radiological Protection

INEL. Idaho National Engineering Laboratory

Acronyms

IRTS. Integrated Radwaste Treatment System

LLD. Lower Limit of Detection

LLW. Low-level Radioactive Waste

LLWTF. Low-level Liquid Waste Treatment Facility

LPS. Liquid Pre-treatment System

LWTS. Liquid Waste Treatment System

MDC. Minimum Detectable Concentration

NCRP. National Council on Radiation Protection and Measurements

NDA. Nuclear Regulatory Commission - licensed Disposal Area

NEPA. National Environmental Policy Act

NESHAP. National Emission Standards for Hazardous Air Pollutants

NIST. National Institute of Standards and Technology

NFS. Nuclear Fuel Services Company, Inc.

NOI. Notice of Intent

NRC. Nuclear Regulatory Commission

NWPA. Nuclear Waste Policy Act

NYSDEC. New York State Department of Environmental Conservation

NYSDOH. New York State Department of Health

NYSERDA. New York State Energy Research and Development Authority

NYSGS. New York State Geological Survey

OSR. Operational Safety Requirement

QA. Quality Assurance

QAP. Quality Assurance Program

QC. Quality Control

RCRA. Resource Conservation and Recovery Act

Acronyms

RMW. Radioactive Mixed Waste

SAR. Safety Analysis Report

SARA. Superfund Amendments and Reauthorization Act

SDA. (New York) State-licensed Disposal Area

SI. International System of Units

SPDES. State Pollutant Discharge Elimination System

STS. Supernatant Treatment System

SWMU. Solid Waste Management Unit

SSWMU. Super Solid Waste Management Unit

TLD. Thermoluminescent Dosimeter

USGS. U.S. Geological Survey

WNYNSC. Western New York Nuclear Service Center

WVDP. West Valley Demonstration Project

WVNS. West Valley Nuclear Services Co., Inc.

WVPO. West Valley (DOE) Project Office

Abbreviations for Units of Measure

	<u>Symbol</u>	<u>Name</u>		<u>Symbol</u>	<u>Name</u>
Radioactivity	Ci	curie	Volume	cm ³	cubic centimeter
	mCi	millicurie(1E-03Ci)		L	liter
	μCi	microcurie(1E-06Ci)		mL	milliliter
	nCi	nanocurie (1E-09 Ci)		m ³	cubic meter
	pCi	picocurie (1E-12 Ci)		ppm	parts per million
	fCi	femtocurie (1E-15Ci)		ppb	parts per billion
	aCi	attocurie (1E-18 Ci)			
Bq	becquerel (27 pCi)				
	<u>Symbol</u>	<u>Name</u>		<u>Symbol</u>	<u>Name</u>
Dose	Sv	sievert (100 rems)	Time	y	year
	Gy	gray (100 rads)		d	day
				h	hour
		m		minute	
				s	second
	<u>Symbol</u>	<u>Name</u>		<u>Symbol</u>	<u>Name</u>
Length	m	meter	Area	ha	hectare (10,000 m ²)
	km	kilometer (1E + 03)			
	cm	centimeter (1E-02 m)			
	mm	millimeter (1E-03 m)			
	μm	micrometer (1E-06 m)			
	<u>Symbol</u>	<u>Name</u>			
Mass	g	gram			
	kg	kilogram (1E + 03 g)			
	mg	milligram (1E-03)			
	μg	microgram (1E-06 g)			
	ng	nanogram (1E-09 g)			
	t	metric ton (10 ³ kg)			

Distribution

R. Natoli	DOE-HQ	T. DeBoer	NYSERDA
T. McIntosh	DOE-HQ	S. Harbison	NYSERDA
H. Walter	DOE-HQ	T. Sonntag	NYSERDA
J. Barry	DOE-ID	R. Fakudiny	NYSGS
B. Bowhan	DOE-ID	F. Galpin	USEPA-Washington, D.C.
M.B. Hinman	DOE-ID	F. Caporcuscio	USEPA-Region 2
D.B. Engelman	DOE-ID	P. Giardina	USEPA-Region 2
T. Burns	DOE-ID	J. Gorman	USEPA-Region 2
T. Rowland	DOE-WVPO	R. Novitski	USGS
D. Hurt	NRC-HQ	A. Stevens	SNIHD
M. Austin	NRC-Region 1	C. Halgas	CCHD
J. Roth	NRC-Region 1		
P. Counterman	NYSDEC-Albany	W. Paxon	U.S. Congressman, 31st Dist.
P. Merges	NYSDEC-Albany	A. Houghton	U.S. Congressman, 34th Dist
R. Baker	NYSDEC-Region 9	D. Moynihan	U.S. Senator, New York
B. Bartz	NYSDEC-Region 9	A. D'Amato	U.S. Senator, New York
P. Eisman	NYSDEC-Region 9	J. Present	New York Senator, 56th Dist.
M. Jackson	NYSDEC-Region 9	P. McGee	New York Assemblyman, 149th Dist.
	NYSDEC-Region 9		
B. Ignatz	NYSDOH-Buffalo	Concord Public Library	
K. Rimawi	NYSDOH-Albany	Springville, New York	

*News release summary

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Buffalo News, Buffalo, New York *

Salamanca Republican Press, Salamanca, New York *

Springville Journal, Springville, New York *